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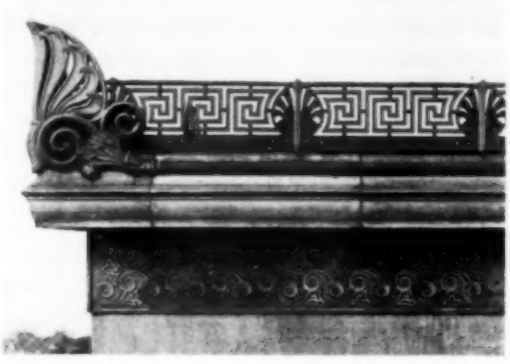
Castings Fit the Needs of Modern Architecture

EVERY age has had its particular styles of architecture expressing the artistic ideals of the era and the materials at the command of the artisan. The cave man had the urge to make his place of dwelling something more than a shelter. Drawings in colored clay remain from his handiwork. Buildings of the ancient Greeks are models of artistic excellence, reflecting as they do the life of the times and the skill and taste of their builders in working in carved stone. In the middle ages terra cotta was much used as a material for architectural decoration, and many elaborate pieces remain as examples of the particular forms of art practiced by the people. The custom of building decoration in terra cotta disappeared with the complete establishment of pseudo-classic uniformity of design throughout Europe, but it was revived in the United States shortly after 1850. As the terra cotta succeeded the carved stone it is only natural that metals should succeed terra cotta in an age of excellence in the metal-working arts. The cast aluminum cornice shown is particularly fitting and indicates the trend, modern materials for modern buildings.



The Cast Aluminum Cornice Combines Strength and Beauty in Modern Building

Find Where Castings Can Be Sold

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Fig. 1—Matchplates for the Dome Casting on One Type of Furnace

Tennessee

By
Frank G. Steinebach

SINCE 1742, when Benjamin Franklin, scientist, philosopher and diplomat, invented the open-front, house heating stove, the American public appears to have been partial to heating units in which castings constitute the principal materials of construction. While the design of stoves has undergone radical changes since the Colonial days and new types of fuels have supplanted, to a large extent, the wood burned as the chief fuel during the eighteenth and the greater part of the nineteenth centuries, gray cast iron still maintains its leadership in the field of stove manufacture and research is strengthening that position.

Of the numerous inherent characteristics of gray cast iron which probably led Franklin and other experimenters to select that material for the early stoves, it is probable that the ease with which the intricate designs could be reproduced on the surface of the various parts forming the stove had the most important bearing upon the decision. For the early models of house heating equipment were replete with ornamentation and only within recent years has that phase of stove design been subject to extensive modifications. Nevertheless, the student of art probably would pronounce the stove of 1931 far more beautiful than some of its predecessors, mainly because of its greater simplicity.

Back in the early days of the American re-

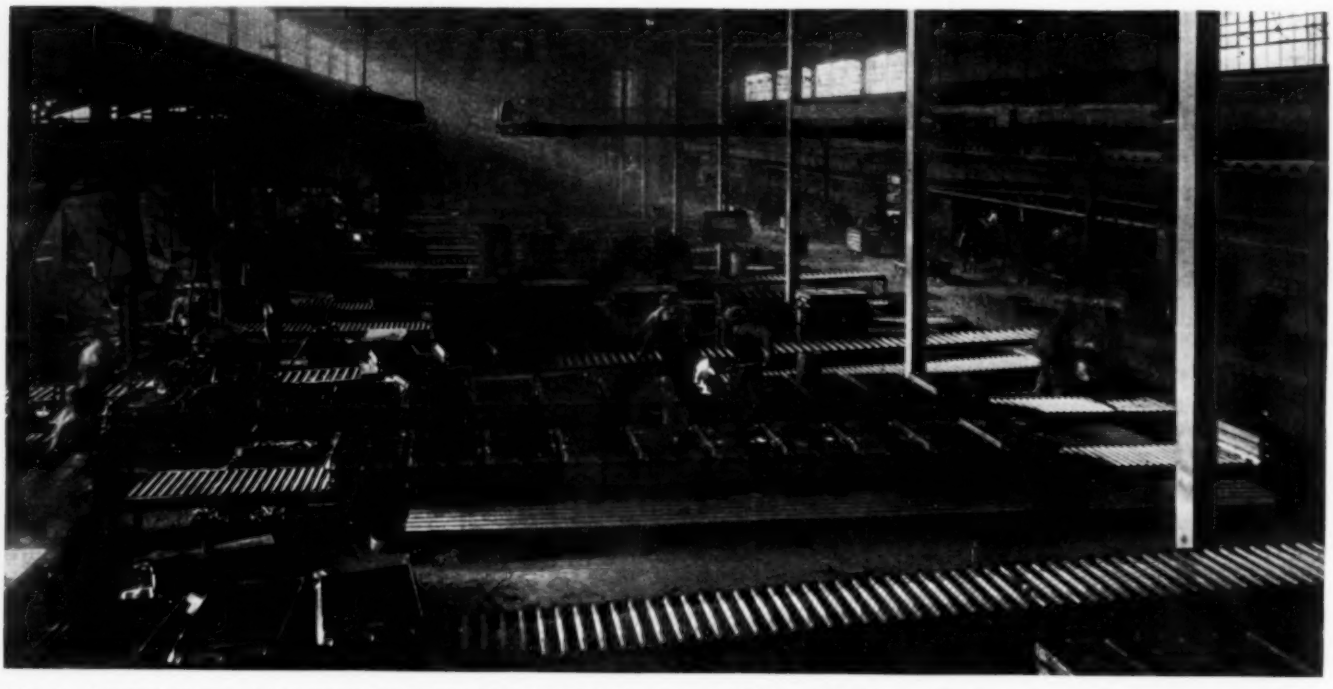


Fig. 2—General View of the Foundry Floor Showing Location of Molding Machines, Mold and Sand Conveyors, Melting Equipment and Sand Preparing Unit

Shop Makes Stove Castings With Production Equipment

public, only the well-to-do were privileged to heat with the stove, so that for many years the fireplace held a most important position in any plans for heating dwellings. However, as the art of stove manufacture progressed, the market for that product also developed and stove manufacturing plants became established in various sections of the country. Over 60 years ago, or in 1867 to be exact, W. F. Allen started a small company in Nashville, Tenn., to build stoves. The business prospered from the start, and by 1892, the company was operating on a comparatively large scale. In 1906 the company was incorporated as the Allen Mfg Co., the name under which the firm operates today.

The constant aim of the company to better its product led to the introduction of the *Allen Princess Range* in 1906, with many new features which immediately won favor. This line of ranges, built entirely of cast gray iron, is manufactured today in varying styles, sizes and finishes to meet widely diversified requirements. Many of these ranges, beautifully finished in several lighter shades of enamel, should be an attractive addition to any kitchen. Of course, the foundry forms an important and exceedingly necessary division of the stove producing company, for, as previously mentioned, the ranges are constructed principally of castings. For example, in the largest size of all cast range built by the Allen Mfg. Co. about 480 pounds of gray iron castings are used.

In 1920 the company took an important step when it intrcduced the first *Allen's Parlor Furnace,* a product which has been advertised widely in newspapers, magazines and over the radio as combining the old-time fireside cheer with modern heating efficiency. The furnace is finished in porcelain enamel and grained to resemble walnut or mahogany wood. Many features are claimed for this type of furnace, which is patterned after cabinet-type talking machines or certain types of radio cabinets. Perhaps the most important point is economical operation, for it is claimed that it is possible to obtain about three times the heating capacity with the new

Fig. 3—Metal, Melted in Two Cupolas, Is Carried in Hand Ladles to the Pouring Stations Along the Conveyors. The Shakeout Is Located Over the Sand Belt

type of stove as compared with some of the older style stoves, using the same amount of fuel. As in the case of ranges, castings constitute the chief material used in the construction of the parlor furnace.

While parlor furnaces and ranges are the principal products of the company, the growth in the use of gas for heating has led the management to introduce a line of gas burning parlor furnaces. These furnaces are built in six styles, several being designed to represent a fireplace. Castings are used in the gas furnaces, although in not as large quantities as in the other types of furnaces and stoves built by the company.

It is interesting to note that while the products of the Allen Mfg. Co., are distributed from stock in warehouses located from Boston to San Francisco and Seattle and from Minneapolis to Dallas, the larger part of the business of this company located in the South is being secured from the Northern states. However, the company points out that the economical operation of the parlor furnace also makes it particularly adapted to more moderate climates, and that the market in the South continues to develop.

A little over two years ago the company decided to build a new plant, in which would be incorporated the latest equipment and processes relating to its particular problems. At that time the manufacturing facilities were located in buildings on Ninth and Tenth avenues between Union and Cedar, within three blocks of the heart of Nashville's business district. After considering all of the many advantages and disadvantages introduced by such a plan, the management decided to build the new plant at Franklin, Tenn., a county seat town about 18 miles southwest of Nashville. At the edge of the city, on the main pike from Nashville to Franklin and near the Louisville & Nashville railroad, the company has built an exceptionally fine and exceedingly modern manufacturing plant, consisting of a foundry, cleaning department, pattern shop, plating department, enameling department with continuous type ovens, a sheet metal shop, conveyor assembly lines and a shipping and storage department. In addition, a fine office building has been built immediately in front of the factory buildings. The new plant was placed in operation in May, 1930.

Straight line production is a feature of the establishment, starting with the foundry at the far end of the plant and continuing through the other departments. The foundry, which is shown partially in Fig. 2 and as a plan view in Fig. 4. is located in a room approximately 120 x 264 feet. Molding, pouring and sand preparing operations are performed here, while the castings are cleaned in the room located at the left of the layout as indicated in Fig. 4. In addition, an exceptionally complete pattern shop is operated by the company in a smaller building built parallel to one side of the building.

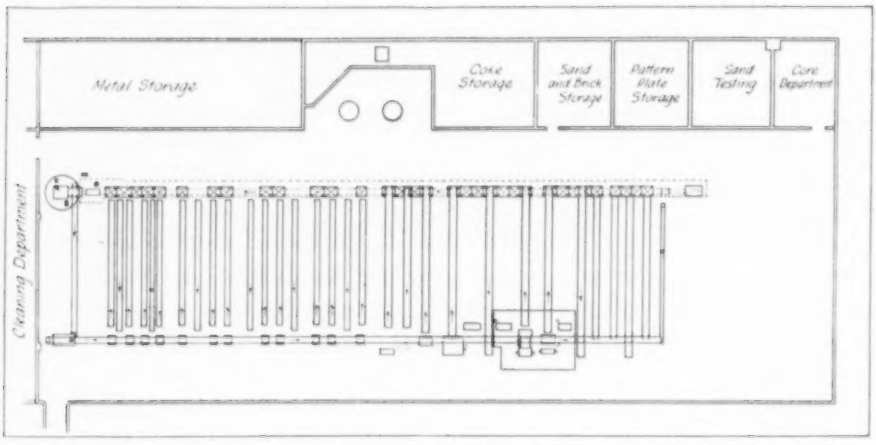


Fig. 4—Sketch Showing the Location of the Various Departments in the Foundry

All sand in the new foundry is handled on a continuous unit from shakeout to the molding machine. This preparing unit, which is located at one end of the foundry, as shown in Fig. 4, was installed by the Link-Belt Co., Chicago. Sand at the shakeout falls on a rubber belt conveyor and is carried to the elevator at the end of the belt. The elevator takes the sand to the top of the building, where it is dumped into a screen and the scrap iron and other refuse removed. The Allen company has developed a special screen which has been placed in the chute carrying the refuse to the floor, so that the scrap iron is removed from the remainder of the refuse and is dumped into a box ready for recharging into the cupola.

Good sand from the screen at the elevator falls into a circular storage bin of 75 tons capacity, later to be fed mechanically from the bottom of the bin on an inclined belt conveyor. After being carried across the end of the building, it passes through a pug mill and an aerator and then falls on a belt conveyor which carries it to the bins above the various molding stations. Excess sand remaining on the distributing belt at the end is carried by a smaller conveyor and discharged on the shakeout belt, again passing through the system.

Twelve molding machines of the plain squeeze type, manufactured by the Adams Co., Dubuque, Ia., and the Osborn Mfg. Co., Cleveland, are utilized in making molds for the small castings. These machines are located under the sand bins and at the end of gravity roller conveyors, supplied by the Mathews Conveyor Co., Ellwood City, Pa., which extend to the shakeout grating, as shown in the accompanying illustrations. The mold carrying conveyors are built at a slight incline to facilitate the movement of the molds from the machine to the pouring zone and then to the shakeout. Six return conveyors which slope gradually from the high point at the shakeout carry the flasks and bottomboards to the machines, one return conveyor serving two of the squeezer machines.

Large Jobs Rolled Over

The larger molds are made on two rollover and two squeezer machines made by the Herman Pneumatic Machine Co., Zelienople, Pa., and one rollover and one plain jolt table supplied by the Osborn Mfg. Co., Cleveland. One of these machines is shown in Fig. 5. The roll over machines are located at the ends of the roller conveyor lines, so that the drag half of the mold is rolled over and comes to rest on the conveyor. The cope is made on a jolt table, which is provided with stripping lugs. After the cope has been made and stripped, it is picked up by pneumatic hoist operating on a monorail, is rolled over and then placed on the drag which already rests on the roller conveyor. The pneumatic hoists used in this work were supplied by the Louden Machinery Co., Fairfield, Ia. A roller conveyor also is provided to return the flasks and bottom boards to each pair of machines.

Three mold carrying conveyors and two return conveyors also are provided just beyond the molding machines indicated at the right in Fig. 4. As shown in the foreground in Fig. 5. some of the molds made by hand are rammed up on small benches located at the ends of the roller conveyors and the molds are then placed on the conveyors. Sand from the storage bins above may be directed in the flasks by the aprons, also shown in the illustration. It has been found that this layout facilitates hand molding, and at the same time carries the molds to the pouring zone where they are poured continuously. Other floor work is accomplished in the floor space shown at the extreme right in Fig. 4. However, the work of making matchplate patterns for the machine molding of parts now produced on the floor

is going forward constantly, thus decreasing the amount of floor work necessary.

Iron is melted in one of two cupolas located on the opposite side of the building from the molding machines, as shown in Fig. 4. The cupolas are lined to 36 inches and recently the slag holes were sealed and the units equipped with slagging spouts. Metal charges are made up in the metal storage yard, shown in the upper left of Fig. 4, and in the coke storage, shown at the right of the cupolas. The charges are weighed and then carried to the charging floor on an elevator immediately in the rear of the cupolas. Blast is supplied by a blower built by the General Electric Co., Schenectady, N. Y.

Pour from Platforms

While the monorail system shown in Fig. 3, which was built by the Cleveland Electric Tramrail division of the Cleveland Crane & Engineering Co., Wickliffe, O., is designed to handle metal from the cupolas to the various pouring conveyors as well as to carry the castings from the shakeout to the cleaning room, at present the individual members of the pouring crew catch the metal in hand ladles as it comes from the cupola spout. As may be noted in Fig. 2, a platform has been built on each side of the pouring conveyor, with a slope equal to that of the conveyor. This places the pourer working on the platform always at exactly the same height above the molds. Eight men take care of all the pouring on the various floors.

As the molds are poured they are moved down the conveyor toward the shakeout grating. The small, snap molds are shaken out by hand, and the larger molds are picked up with one of two pneumatic hoists equipped with vibrator shakeouts. The hoists were supplied by the Curtis Pneumatic Machinery Co., St. Louis, and the vibrators by the Stoney Foundry Engineering & Equipment Co., Cleveland. The sand falls through the grating to the shakeout belt previously described. Seven men shakeout all of the castings.

The castings are checked by a discount man immediately after being shaken out and those that are not satisfactory are placed in bins to be charged against the molder and then returned to the scrap yard. This system prevents a good percentage of the scrap castings from going through the cleaning operations before being detected. The good castings are then placed in boxes to be transported to the cleaning department. In addition to the seven shakeout men and the one employe checking castings, two men knock off the gates and risers and keep the gangway clean and one man hauls the castings from the gangway.

The cleaning department is located in a room adjacent to the main foundry, as shown in Fig. 4. The equipment consists of four square tumbling barrels made by the W. W. Sly Mfg. Co., Cleveland, six round tumbling barrels, two stand grinders, one of which was built by the Cincinnati Electrical Tool Co., Cincinnati, and a large rotary table type sandblast supplied by the Pangborn Corp., Hagerstown, Md. Practically all of the castings are tumbled and the fins, pieces of gates, etc., are ground off with the grinders. Castings to be enameled or plated are sandblasted to provide the smooth finish necessary for that type of work.

Only an exceedingly small number of cores are used in the class of work made at the Allen foundry, and the cores used are small in size. They are made in a small department at one end of the foundry, as shown at the upper right in Fig. 4. However, the company will increase the amount of core work as the production of gas burners for its line of gas stoves is increased.

Exact control of the sand in the system is exercised with the aid of complete sand testing apparatus designed by H. W. Dietert Co., Detroit. Sand control is an important feature in that type of work, since small surface defects or imperfections, which ordinarily would be considered too trivial to affect the utility of the casting, will not permit the casting to be enameled. For that reason, considerable attention is paid to the condition of the sand.

Due to the importance of good pattern equipment in increasing production and reducing costs, the Allen Mfg. Co. maintains an extensive pattern department. Since the completion of the new plant, the pattern shop not only has been engaged in making patterns for the new styles and types of stoves that constantly are being designed to meet the whims of a fickle buying public, but also in making matchplates for many of the patterns previously molded on the floor. In this process, much of the work now is going to the machines and the conveyor lines.

When a new style of stove is to be placed in production, the drawings are sent to an outside shop which specializes in making master patterns in wood of that type of work. When these patterns are received at the patterns shop of the Allen Mfg. Co., they are checked carefully and then white metal patterns are cast. These white metal patterns are used to cast the aluminum matchplates. Scrap aluminum transmission and crank cases, melted in an iron pot and fluxed with zinc chloride provides the metal for these matchplates.

Fig. 5—Chutes Carry the Sand to the Flasks Located on the Molding Machines

An interesting example of one class of matchplate work made by the pattern shop is illustrated in Fig. 1. The plate is for two dome castings utilized in one type of parlor furnace made by the company. This particular dome casting is 14 inches deep, 13 inches wide and 20 inches long. Two patterns are mounted on one plate which requires a flask 26 x 45 inches. The thickness of the metal in the finished casting at the thinnest section is 3/16-inch. One of the interesting features of this particular casting is the ribs, which are added to the dome to increase the heat radiating surface. At several points along these ribs it is necessary to exercise great care in the pattern shop to provide the proper draft for a clean lift when the plate is drawn from the sand.

Each particular style furnace is made in several sizes, thus requiring a gradation in the sizes of castings used. Instead of making master patterns for each size of stove, it is pos-

sible in many cases to make patterns plates for the various sizes of castings with only one master pattern. White metal patterns cast from the master patterns for the largest size casting are sawed through the length and the breadth, a sufficient amount of the metal removed to give a pattern of the required size, and the parts fitted together again to provide a pattern for casting the matchplate. The employes in the pattern shop of the Allen Mfg. Co. are especially skilled in providing adaptations to decrease production costs.

As in practically any other type of foundry work, gating the casting properly is an ever present problem. Experience gained through years of similar work is a valuable guide in solving gating problems on new types of work. However, the gating of each casting is considered as an individual problem, with both the foundry superintendent and the pattern shop superintendent co-operating in determining the best methods to be followed.

As may be noted in Fig. 1, each of the two castings on the plate is provided with two sprues, two runners and six gates. Two gates are located on each of the ends and two are provided along one side. With two castings to a mold and the pouring being accomplished with hand ladles, four men are required to pour the mold made from the plate shown.

The company is under the direction and guidance of the Allen family since its organization. W. F. Allen, a son of the founder of company, is president, having been identified with the business for over 30 years. Neil H. Cargile is secretary, engineer and plant manager and A. H. Wood is treasurer. Active management of foundry operations is under the direction of George D. Emerson, production manager, Clyde L. Hindman, foundry superintendent and W. J. Boyd, pattern shop superintendent.

Address Foundrymen

Wayne D. Axtell, exhibits department, Century of Progress, Chicago, addressed the members of the American Foundrymen's association at the recent convention on the proposed exhibit of the foundry industry in that celebration. The proposed exhibit is based on a report prepared by a subcommittee of the science advisory committee of the National Research council to the exhibition. Harry A. Schwartz, director of research, National Malleable & Steel Castings Co., Cleveland, is chairman of the subcommittee on iron, steel and nonferrous metals which rendered the report.

Pittsburgh offices of the Continental Roll & Steel Foundry Co. have been moved from the Union Bank building to 2105 Grant building.

A.S.T.M. Symposium Has Array of Papers

Thirty papers have been prepared for the joint symposium of the American Society for Testing Materials and the American Society of Mechanical Engineers on requirements for and trends in the engineering industries using alloys at high temperatures, which will be held under the auspices of the American Society of Testing Materials on June 23 during the annual meeting of the society. The symposium will be divided into two sections; one of which will be held in the morning and the other in the afternoon.

The first session will be under the direction of President K. G. Mackenzie, chairman, and A. D. Bailey, Commonwealth Edison Co., vice chairman. The discussion will be opened by L. W. Spring, Crane Co., Chicago, who will present a summary of the following papers relating to the needs of the power plant industry: "Steam Boilers and Superheaters," by H. J. Kerr, Babcock & Wilcox Co., New York; "Turbines," by R. C. Allen, Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa.; "Valves Pipes and Fittings," by F. W. Martime, Sargent & Lundy Inc., Chicago; "Needs of the Oil Industry," by E. S. Dixon, Texas Co., New York; "Corrosion and Other Problems in the Use of Metals at High Temperatures in the Chemical Industry," by F. H. Rhodes, Cornell university, Ithaca, N. Y.

"Needs of the Ferrous Metal Industries." by J. C. Woodson, Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa.; "Needs of the Nonferrous Smelting Industries," by R. E. Brown, Electro Metallurgical Corp., New York; "Needs of the Automotive and Aeronautic Industries," by A. L. Boegehold, General Motors Corp., Detroit, and J. B. Johnson, Wright field, Dayton, O.; "Needs of the Ceramic Industries," by C. E. Williams, Battelle Memorial institute, Columbus, O.; "Engineering Trends in the Use of Metals at High Temperatures," by J. H. S. Dickenson, English Steel Corp. Ltd., Sheffield, England, R. W. Bailey, Metropolitan-Vickers Co., Manchester, England, Dr. Pearson and Dr. Inglis, both of the Imperial Chemical Industries, London, England; "Influence of Temperature on Properties of Heat-resistant Alloys," by Drs. B. Strauss, Schotty, and Schaftmeister, Friedrich Krupp A. G., Essen, Germany; and "Fundamental Phenomena Governing the Performance of Metals in High Temperature Service," by Dr. P. Chevenard, Societe de Commentry-Fourchambault et Decazeville, Imphy, France.

The second session which will be held in the afternoon will be under the direction of Dr. F. M. Becket, Electro Metallurgical Corp., New York, chairman, and Dr. P. D. Merica, International Nickel Co., New York. H. J. French, International Nickel Co., New York, will open the discussion by presenting a short summary of the following papers: "Zinc-base Alloys at Temperatures above Atmospheric," by H. A. Anderson, Western Electric Co., Chicago; "Light Alloys of Aluminum and Magnesium at High and Low Temperatures," by R. L. Templin, Aluminum Co. of America, Kensington, Pa.; "Bearing Metals," by E. R. Darby, Federal Mogul Corp., Detroit.

"High and Low Temperature Properties of Cast Carbon and Low Alloy Steels," by R. A. Bull, Electric Steel Founders' Research group, Chicago; "Cast and Malleable Iron Properties at High Temperatures," by J. W. Bolton, Lunkenheimer Co., Cincinnati, and H. Bornstein, Deere & Co., Moline, Ill.; "Cast Austenitic Alloys and Non austentic Alloys of Iron, Nickel and Chromium," by N. B. Pilling and R. Worthington, International Nickel Co., New York; "Nickel and Nickel Alloys," by C. A. Crawford and R. Worthington, International Nickel Co., New York.

"High Chromium Steels for Extreme Service Conditions," by C. E. MacQuigg, Electro Metallurgical Corp., New York; "Low Temperature Properties of Metals," by H. W. Russell, Battelle Memorial institute, Columbus, O.; "Thermal Expansion of Metals in Relation to High Temperature Service," by N. L. Mochel, Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa.; "Thermal Conductivity of Metals in Relation to High Temperature Service," by M. S. VanDusen, bureau of standards, Washington, with discussion by P. E. McKinney, Bethlehem Steel Co., Bethlehem, Pa.; and "Bibliography of Recent Literature on Effect of Temperature on Properties of Metals," by L. F. McCombs, Battelle Memorial institute, Columbus, O. Preprints of the papers mentioned may be obtained from C. L. Warwick, secretary, American Society of Testing Materials, 1315 Spruce street, Philadelphia.

Core Ovens Described

Foundry Equipment Co., Cleveland, has issued a bulletin giving information on the various types of core oven that it manufactures and erects. The company has been in operation over 27 years and has designed and installed approximately 4000 ovens of various types. Reproductions from photographs are used throughout the booklet to show some of the installations and blue print drawings show the design features and layout. One of the most recent installations is the 5-tier core oven in the plant of the General Steel Castings Corp., Eddystone, Pa. An explanation accompanies the illustrations and drawings of each installation.

Deep Etch Is Valuable Tool To Brass Foundrymen

By R. W. Parsons

DEEP etching of brass is accomplished by subjecting the specimen to the action of concentrated commercial nitric acid for a period of 7 to 8 minutes, depending upon the size of the piece and the amount of acid used in relation to the surface of the specimen. For etching brasses containing tin, 10 per cent of commercial hydrochloric acid usually is added to keep the tin oxide in solution.

Test Bars Are Cast

A few years ago, a considerable number of tensile test bars were required to investigate the effect of corrosion on the physical properties of various alloys subjected to the action of locomotive smoke. It was desirable that all specimens be cast from the same ladle of metal to introduce as few variables as possible.

With the standard A. S. T. M. tensile bar, which required about 10 pounds of metal to produce one specimen, several heats and a multitude of molds would have been necessary for the number of bars desired. To simplify the molding and melting, a method of gating was developed, without recourse to the etch test, which gave three bars per mold and sufficient molds to the ladle so that the entire lot of a given composition could be poured from one small heat. The method of gating is shown by the sketch of Fig. 3. The mold was poured uphill at about 7 degrees to the horizontal.

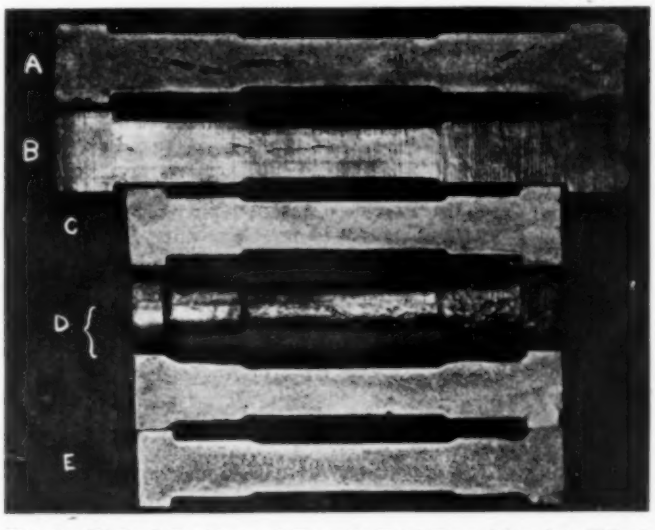
After this method of gating had served the purpose for which it was developed, it was adopted for routine checking, since it offered several advantages. The center bar was removed later when it was felt that duplicate bars would be sufficient for regular testing.

Physical properties obtained from these tensile specimens compared favorably with those from the A. S. T. M. bar, but it soon became apparent that something was amiss. Porosity was in evidence or the fractures were sound, depending upon where the bars fractured with respect to the center of the gage length.

Defects were revealed by etching the section, Fig. 1-*A*, although the pronounced shrinkage cavity was visible before etching Fig 1-*B*. This information could have been obtained from fractures as well, but a whole series would have been required to furnish equivalent information. The gated end was identified by marking the pattern with a stencil. Several changes were made in an effort to eliminate the shrinkage at the end of the gage length. Working on the assumption that for a given cross-section there is some definite limit to the length that can be cast sound, the bar was shortened to give the minimum length, outside the gage length, which would fit the holders of the tensile machine. With the shorter bar and a layout quite similar to the first tensile bar gating, shown in Fig. 3, a sound specimen was obtained as shown in Fig. 1-*C*.

Bars Are Sound

In this second method of gating as shown in Fig. 4, the risers were set closer to the ends of the bars and the gates were considerably smaller. Less than five pounds of metal were required to pour one mold and produce two bars. Uphill pouring gave a cleaner surface than was obtained by pouring downhill with the risers next the sprue, although both methods gave equally sound castings as shown by the deep etch. Pouring the bar level with the sprue acting as the only feeder, served satisfactorily as far as soundness of the etched section was concerned as shown in Fig. 1-*D*, but with this method the gate had to be left wide open and the bars were so dirty that they had to be machined undersize. With the test bar cast parallel to a runner on which two risers were placed so as to feed into the sides of the collars



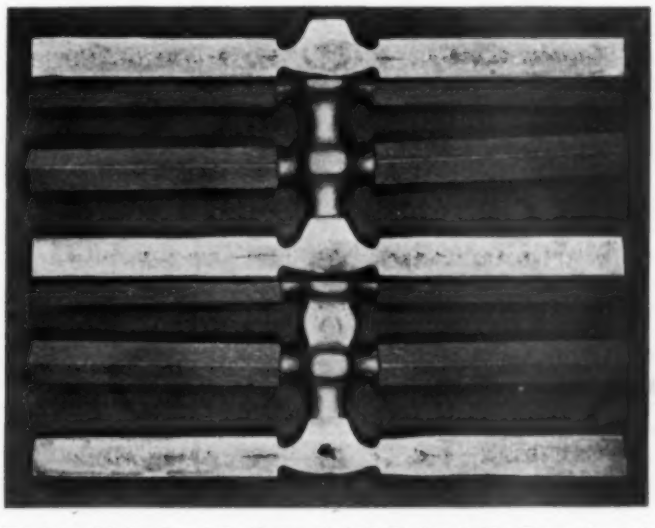


Fig. 1—Etched Sections of Tensile Test Bars Showing Effect of Various Methods of Gating. Gated Ends of the Bars Are at the Right. Fig. 2—Method of Gating Izod Impact Specimen. Alternate Bars Are Etched to Show Defects

Defects Revealed

A PAPER on the deep etching of brass was presented at the Cleveland convention of the American Foundrymen's association by W. F. Graham and L. A. Meisse, Ohio Brass Co., Mansfield, O., and later was published in abstract form in THE FOUNDRY *in the July* 1, 1930 *issue under the title "Defects in Cast Brass Are Revealed by Deep Etching." The present article presents a further consideration of the process as applied to gating problems in the brass foundry and is abstracted from a paper presented at the Chicago convention of the A. F. A. The author, who is metallurgist, Ohio Brass Co., points out that although the deep etch method is a valuable tool, certain limits must be placed on the application of the test to foundry problems of red brass in general. He explains that its practically impossible to draw any conclusions with regard to metal conditions from etched sections of dis-similar castings because gating plays such an important part in determining the quality of the castings. However if the results of the etch test and the method of gating are studied for similar castings, an improvement in the quality of the casting may be made.*

at the ends of the bar, the feeding was not satisfactory as shown in Fig 1-*E*.

The pouring temperature is important in the same way that each job in the foundry has its own proper pouring temperature. The chart of Fig. 5, plotted from five points, shows how the physical properties vary with pouring temperature with the second tensile bar method of gating. The same alloy and a fixed pouring temperature were used in all experiments with the gating of test pieces.

Etched sections, shown in Fig. 2, from a mold containing 12 castings for Izod impact specimens of the three notch type, showed that the risers were not adequate to properly feed the castings. The surfaces of the castings were usually dirty, so no attempt was made to increase the size of the gates in the above. Again working on the theory that there is a limit to the length which can be cast sound with a given cross-section, a mold was stopped off so that the castings were shortened to the length of a single-notch Izod specimen. An improvement was effected by decreasing the length, but the etched specimens still showed considerable porosity.

Since 12 specimens were more than were needed for the usual tests, a gate having four pieces was made, similar to the second tensile bar gating, Fig. 4, and poured uphill as before. With the gates sufficiently thin, so that the casting did not feed back into the gate, good results were obtained as shown in Fig. 6-*A*, while with a thicker gate, as shown in Fig. 6-*B*, the casting fed back into the gate. The risers of the tensile and impact bars do not show a pronounced shrinkage cavity because, to obtain the maximum physical values, the pouring temperatures are low. The fact that these are *dead* risers also has considerable influence since some *pipe* would be developed, even at the low temperature, if the risers were next to the sprue. At higher temperatures, the risers on both types of test bars, Fig. 4 and 6, develop moderate shrinkage cavities.

A riser which exhibits a large shrinkage cavity is shown in Fig. 6, *C* and *D*. Incidentally, this is of the same alloy and poured at practically the same temperature as the test bars. It is interesting to note to what extent the *hot spot* inclines to the right Fig. 6-*C*, which is in the direction of feeding.

A globe-valve body with a drain cock attached shown in Fig. 7, *A* and *B*, illustrates an application of greater interest to foundrymen than the production of test bars. These castings were produced on a machine where both cope and drag were made from a single plate. This necessitated a rollover of the drag side so that the drains on one side of the center runner were in the cope, Fig. 7-*A* and those on the opposite side of the runner in the drag side of the mold, Fig. 7-*B*.

It will be seen that, with the drain in the drag the adjacent thin section partially has fed the drain, leaving a considerable area of shrinkage. It was found that in 80 per cent of the leakers, the drains had been cast in this position. Regating this pattern with all the drains in the cope reduced the average leak losses from 5 to 1 per cent.

In connection with examination of light brass castings, it might be well to point out that gating is such a vital factor in regard to the quality of etched sections, that it often is difficult to discern any connection between the results of the etch and other factors which may be under investigation, unless the gating is kept constant through use of a single pattern. As an example, it was found that etched sections of dissimilar castings, one casting from each heat, taken over a period of weeks, showed that the samples from certain patterns were good with few exceptions, while those from other patterns were poor regardless of the character of the material charged into the furnace. This condition held even though the castings were from the same heat of metal. Thus, whatever information existed regarding metal conditions,—such as comparisons of ingot quality furnace practice, etc., this information was obscured by the lack of uniformity in the character of the specimens made from the melted metal.

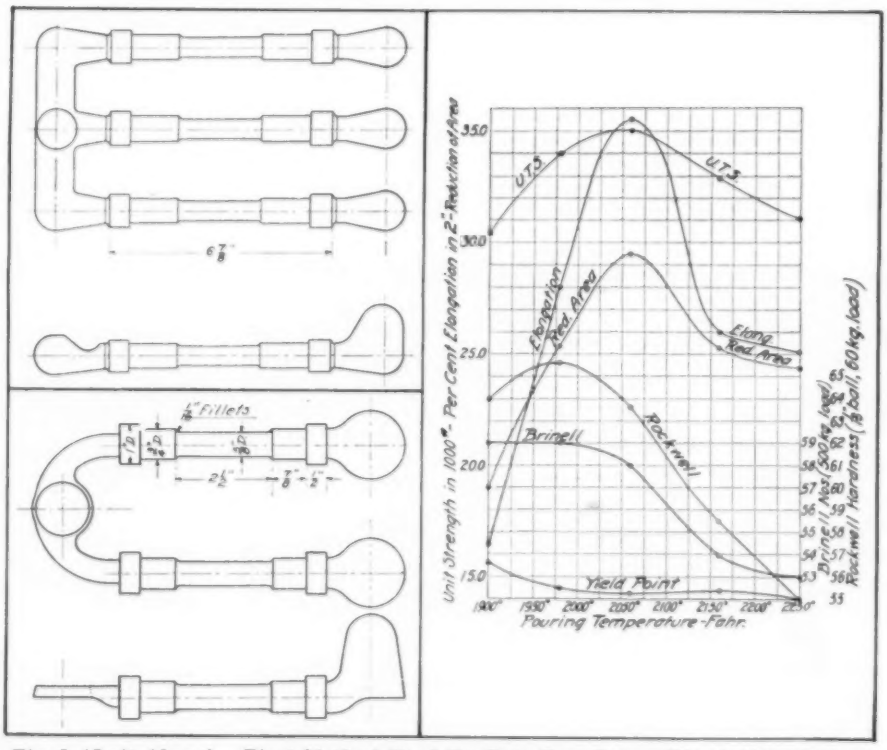


Fig. 3 (Left Above)—First Method Used To Gate Test Bars. Fig. 4 (Left Below)—Second Method of Gating Which Produced Sound Test Bars. Fig. 5 (Right)—Effect of Pouring Temperature on Physical Properties of an Alloy Containing 84.64 Per Cent Copper; 3.38 Per Cent Tin; 3.14 Per Cent Lead; 8.84 Per Cent Zinc

Etched sections from two different patterns, which were poured in succession from the same ladle of metal and sectioned through the gate in both cases, show different distribution of shrinkage and variance in quality as shown by the etch test. Those are shown in Fig. 7, *C* and *D*.

One casting, illustrated in Fig. 7-C, shows a shrinkage cavity localized at the gate and exhibits an excellent surface throughout the remainder of the section, while in the other casting, as shown in Fig. 7-*D*, the shrinkage is distributed well around the circumference. Thus, sections made at random through these particular castings would create the impression that the former, with the localized defect, Fig. 7-*C*, was the better metal.

The deep-etch test can be useful in connection with problems of gating which have to do with the production of sound castings. In collecting information on the internal soundness of red-brass castings, the deep-etch test offers certain advantages over the older method of fracturing the piece, in that sections can be made longitudinally and through heavy sections which would be difficult to fracture. A clearer and more complete picture of the condition is obtained through the greater portion subjected to examination, and the chances for detection of defects are somewhat greater with the etched sections. It is apparent that there are certain limits to be placed on the application of the deep-etch test to foundry problems in general. It is practically impossible to draw any conclusions with regard to metal conditions from etched sections of dissimilar castings, since gating plays such an important part in determining the quality which the etch test reveals.

Jones Sand Co., Rowlands building, Columbus, O., has opened a new pit near Killbuck, O., for the production of foundry sands.

Detroit Foundry Group Installs Officers

The annual ladies night party of the Detroit Foundrymen's association was held at the Ft. Shelby hotel, May 21. The party was staged in the Spanish grill of the hotel and entertainment consisted of dancing, bridge and some special numbers presented by entertainers. Following the banquet and selections by the Boys Band, a brief business session was held which was followed by the installation of officers. New officers of the association are James L. Mahon, president; Peter W. Mulder, vice president; Neil I. McArthur, secretary and Fred A. Cowan, treasurer. Members of the executive board are Fred J. Walls, Harry Rayner, Leslie G. Korte, Vaughan Reid, and Bert Crawford.

J. D. Stoddard acted as toastmaster and the address of the evening was made by the Hon. Frank Murphy, mayor of Detroit. Richard W. Reading also spoke.

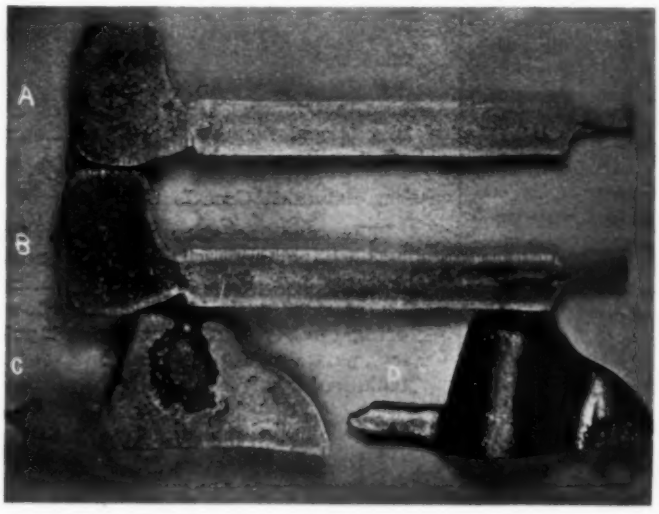
Quad-City Foundrymen Elect Officers

E. A. Gullberg, Union Malleable Iron Works, East Moline, Ill., was elected president of the Quad-City Foundrymen's association at the regular monthly meeting held at the Fort Armstrong hotel, Rock Island, Ill., May 18. Charles Scherer, Davenport Machine & Foundry Co., Davenport, Iowa, was elected vice president and S. M. Brah, Tri-City Manufacturers' association was re-elected secretary and treasurer. P. T. Bancroft, John Deere Harvester Works, East Moline, Ill.; Hyman Bornstein, Deere & Co., Moline, Ill.; Charles Demmlar, Walworth Co., Kewanee, Ill.; R. L. Eichman, Bettendorf Co., Bettendorf, Iowa; A. E. Hageboeck, Frank Foundries Corp., Moline, Ill.; F. W. Kirby, John Deere Spreader Works, East Moline, Ill.; A. D. Matheson, French & Hecht Inc., Davenport, Iowa; John H. Ploehn, French & Hecht Inc., Davenport, Iowa; and E. W. Rice, International Harvester Works, Rock Island, Ill., were elected directors.

Talks presented by members of the local group covered interesting points of the American Foundrymen's association convention. P. T. Bancroft reported on the pattern meeting and the standards adopted by the A. F. A. for coloring patterns and core prints. Walter Ranis, Union Malleable Iron Works, East Moline, Ill., spoke on the various discussions in the malleable iron field. Garnet Phillips devoted his attention to a discussion of the shop operation courses in the gray iron field. A. E. Hageboeck spoke for 10 minutes on the "Administration of the A. F. A." and plans for the coming year. He also reported that attendance at the meetings was above the average. John Ploehn gave a talk on the apprenticeship sessions.

The meeting was dedicated to the apprentices of the district. Twenty were present including all the graduates in molding and patternmaking for the past year. Thomas Smedley, Red Jacket Mfg. Co., Davenport, Iowa, winner of the first place in the gray iron molding contest; Victor Sanders, John Deere Harvester Works, East Moline, Ill., second place winner; Rollo Van Camp, French & Hecht, Davenport, Iowa, third place winner; and Herbert Larson, John Deere Harvester Works, East Moline, Ill., first place winner in the patternmaking contests, were the guests of honor. Diplomas were awarded the graduates and each was given a year's membership in the Quad-City Foundrymen's association.

The annual picnic of the association will be held June 20 at Maple Lane Inn, Rock River.



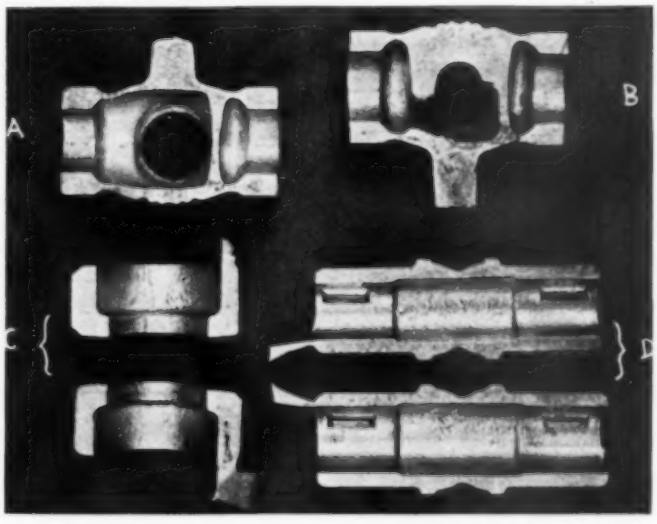


Fig. 6—Etched Sections of Izod Impact Bars Showing the Improvement in Structure After Regating. Fig. 7—Influence of Gating on Unsoundness in Small Globe Valve Body

GRAY IRON

Possesses

Valuable Engineering Properties

GRAY iron often is called an inexpensive material; an economical metal to use if its physical properties and chemical resistance adapt it to the necessities of the design involved. The low cost of gray iron rests not alone on its low cost for molten metal, relative simplicity in molding, and the low costs of producing a high percentage of good sound castings. The low cost also is due in part to its ready machinability, for with the exception of well annealed malleable, gray iron is the most readily machined of the common ferrous alloys.

Similar to hardness, wear resistance, and certain other important properties of gray iron, machinability at present is not definable in definite or specific terms. Machinability is a complex property and is not simple to define or measure. Yet, its general significance is quite well understood—particularly in this day of high speed production.

Great Harm Done

Great harm has been done to the cause of gray iron castings by well-intentioned, but ignorant, production superintendents and ill-informed foundrymen. The necessity for lower costs and high production has in countless cases resulted in vociferous and often profane demands for freer machining iron. Often contrary to their best instincts foundrymen felt they were forced to produce this ultra machinable metal. Usually without technical assistance they began the production of newer type irons, soft and machinable it is true, made into open grained, weak, brittle and easily worn out castings. Such castings did not hold up, they broke, they wore out, they grew readily when exposed to high temperatures.

Failures, costly and sometimes dangerous, were frequent. Engineers, designers, and consumers, sat up and took notice. Lo, cast iron was unreliable! Engineering societies drew up specifications limiting the temperature and pressure applications of gray iron. Numberless designs were changed so that other materials could be employed. Foundry owners cursed their ill luck and bewailed their decreasing profits. However, they did not have the vision or nerve to spend money for technical assistance, technical assistance that in a comparatively brief space of time had made the wild, nonuniform material, known as cast steel, a valuable, tough, sound alloy which rapidly forged its way to the front as a leading ferrous metal.

Overall Cost Is Criterion

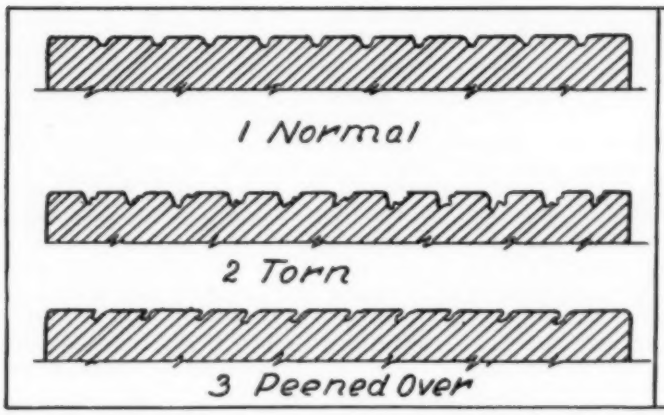
The machine shop man's cry for better machinability always is justified by economic pressure. Aiding him to cut costs by heedlessly lowering quality is a short sighted policy, particularly so when by careful technical study it quite often is possible to maintain quality and increase machinability. Little assistance can be expected from the corner drugstore, but a well manned technical staff with proper equipment can do much toward establishing and maintaining quality, uniformity, and economy.

Cast iron is a nonductile alloy, and therein lies a portion of the secret of its usual ready machinability. Due to its lack of ductility it turns a short chip, varying from almost a powder on open grained metals and certain kinds of cuts, to an actual short curl chip on tougher metals and other types of cuts. Thus in cutting cast iron the metal usually breaks off in advance of the tool

Is Easy Machining

DEMAND for easy machinable iron has led to the production of open-grained, weak castings. However, investigation has shown that irons of high strength can be machined economically when the proper speeds and tools are used in cutting. Heavy cuts have a tendency to tear the iron and spoil its surface appearance. Gray iron properly made is the most easily machined of the ferrous materials, the reasons for that being given in this article.

Fig. 106—*Pseudo-eutectic Graphitic Structure, Unetched,* 100 *Diameters. Fig.* 107—*Structure Showing Coarse Graphite, Unetched,* 100 *Diameters. Fig.* 108—*Effect of Grinding on Iron Like That Shown in Fig.* 107, *Unetched,* 75 *Diameters*



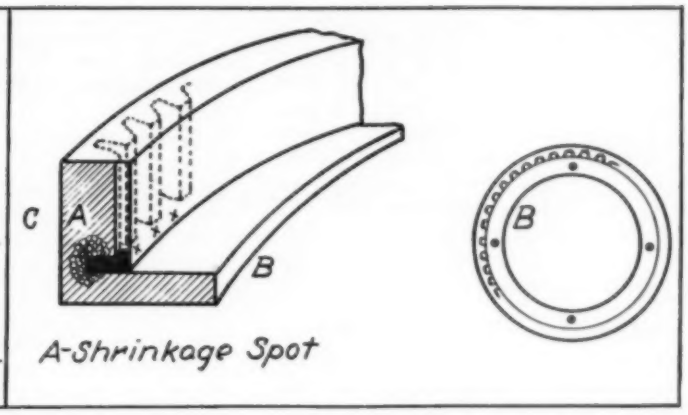


Fig. 109—The Normal Surface Is Torn by Heavy Machine Cuts, and Peened Over by Grinding. ***Fig. 110—Faulty Design of Internal Ring Gear Causes Shrinkage Areas***

whereas in cutting steel the metal is torn off.

Failure of the tool in cutting cast iron usually arises from one of three causes, as follows:

1—When the metal is tough and the speeds high a great deal of heat may be generated and this may destroy the efficiency of the tool. Tools which resist the action of heat, such as stellite therefore sometimes are more efficient for certain cuts than carbon tool steel and high speed steel, which two latter break down at lower temperatures.

2—Due the nature of their microconstituents, certain cast irons have a severe abrasive action on tools. For such conditions extremely hard substances, such as the tungsten carbide materials probably will find steadily increasing applications.

3—In other instances mechanical breakage may result. The use of too heavy cuts on strong metal, gouging, vibration in the tool, cutting into blowholes, or shrinkage cavities and hitting hard or chilled spots may result in actual breakage.

The most common type of tool failure is *burning up*, which may result directly or indirectly from causes classifiable under any of the three headings previously mentioned.

The intrinsic machinability of cast iron is controlled by its structure. The tool cuts because it is more resistant to destruction than the metal being cut. Part of this resistance is dependent on the mechanical means employed, such as obtaining compressive stresses on the tool and tensile stresses on the metal being cut insofar as possible, in obtaining advantageous leverages, etc. Yet, while the tool is *destroying* the metal, the reaction of the metal on the tool tends to lower the efficiency and to result in ultimate destruction of the tool itself.

As explained earlier in this series of articles, gray iron is composed of four major microconstituents. These are graphite, pearlite, ferrite, steadite. In mottled and white or chilled irons another component, cementite is found. These structural components vary in their percentages, size, and distribution.

Graphite flakes are soft and nonabrasive. Experiments show that they actually have a lubricating action minimizing tendency toward galling and seizing. They are dispersed throughout the metal. In fine-grained irons they are not easily visible to the naked eye, but on ordinary machined surfaces of poor grades they show up as tiny pits which cause what is termed *open grained* appearance. As commented on by Bolton, the hand passing over a freshly machined cast iron surface becomes covered with a black shiny substance similar to that obtained from graphite or pencil lead.

Not only are the loosely held graphite flakes in gray iron relatively nonabrasive in this form, but by breaking up the matrix they lower ductility and shorten the chip. More graphite usually denotes lower strength. Other things being equal, increased graphite quite likely raises machinability. Some hold that the finely-divided, equally-distributed flake structure is more machinable than coarse flake structure. This quite possibly is true, but there are so many variables in gray iron metallurgy that it is dangerous to become dogmatic.

A micrograph of an extremely fine or pseudo-eutectic graphite structure in Fig. 106 is shown. The graphite structure of a coarse grained iron is shown in Fig. 107. In Fig. 108, is shown the effect of grinding an open grained iron. The latter is illustrated diagrammatically in Fig. 109 as shown by Bolton. Note that there is a decided peening-over effect which covers up the open grain. By utilizing care in machine cuts and by grinding, an open-grained, weak iron can be camouflaged to appear like a fine grained iron with an excellent finish. However the leopard-skin cloak will not make an athlete out of the weakling.

Conversely, the metal may be torn

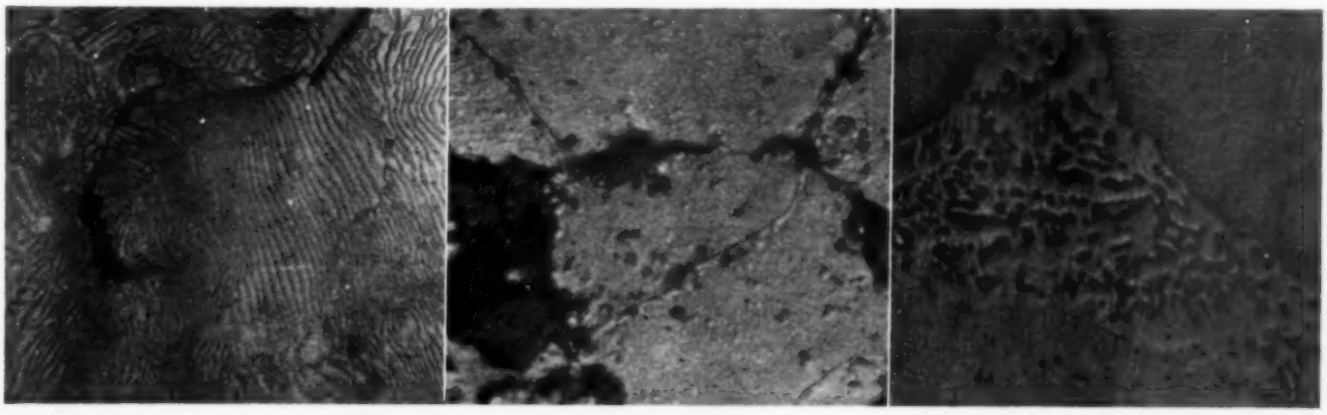


Fig. 111—Pearlite and Fine Graphite, Etched with Picric Acid, 2000 Diameters. ***Fig. 112—Ferrite and Some Graphite,*** *Etched with Picric Acid, 700 Diameters.* ***Fig. 113—Steadite Forms Network Structure, Relief Polished, 750 Diameters***

apart along the graphite flakes in machining and make the metal look somewhat worse than it really is. Too heavy cuts often cause this torn condition. In most places the main loss is in appearance. However, in certain places, threads for example, too heavy cuts may impair seriously the usefulness of the machined part. Of course, a close grained iron is advantageous in practically all engineering applications.

Grain Size Varies With Depth

It is possible to obtain close grain and excellent machinability as will become more and more apparent as the subject is considered further. It suffices to say that for a given strength a softer matrix is possible with a finer grained iron; the net result being equal or increased strength with improved machinability.

In certain grades of iron different appearance and machinability may obtain on different parts of one and the same casting. Bolton explains this as follows—"There are a number of reasons for this; first heavy sections usually are somewhat coarser grained than light sections because the slower cooling rate of the heavy section allows more time for grain growth. Then, also, cuts of different depths may be taken on the same heavy section, and in such instances the deeper cut will show a more open-grained iron because of the slower cooling toward the center of the section permits grain growth."

Near the outer edge of even weak irons, the metal will be fairly close grained for the first ⅛ to ¼-inch. Then from ¼ to 2 inches in depth, there is a rapid increase in grain size in weak irons and some increase in the better grades (made with medium carbon content—the low carbon irons often are uniform through the whole cross section). From 2 inches on there is little increase. These figures are only rough approximations because the grain is affected by the composition of the iron, the total depth of the section, and other factors.

Quoting Bolton again—"Sometimes one part of a large finished lathe bed casting will be more open grained than another, which is probably due to warpage. Where there has been warpage, more metal must be removed from the high spots, and consequently at such points the metal will have a more open appearance." Speaking further on another aspect of open grain he states, "Some castings have local areas of open-grained, spongy metal, and in some cases there may even be jagged holes. These areas result from shrinkage, and are most commonly due to faulty design of the casting." Such an occurrence is illustrated in the sketch of a ring gear shown in Fig. 110. In smaller section castings of improper analysis the occurrence of *picture frame* fracture is not infrequent, and is due to excessive graphitization, as has been explained previously.

The matrix of the cast iron structure is composed of varying amounts of pearlite, ferrite, and steadite. Pearlite is the eutectoid of iron (ferrite) and cementite. These constituents occur in alternate lamellae as shown in Fig. 111. Pearlite is strong and has a brinell hardness around 200. The cementite lamellae being intensely hard and being held rigidly in place between the ferrite lamellae undoubtedly have a severe abrasive action. Pearlite has the characteristics of an 0.80 or 0.90 per cent carbon steel, which, as every machinist knows, is not easy to machine, unless the pearlite has been sorbitized by special heat treatments. Cast iron of 0.60 to 0.75 per cent combined carbon has a substantially all pearlitic matrix, and, other things being equal, is not machined as readily as metal lower in combined carbon.

Ferrite Is Soft

Ferrite, on the other hand is relatively soft (100 brinell) and ductile. It is illustrated in Fig. 112. It contains practically no combined carbon. Structurally it is a great deal like low carbon steel. In the latter material the ductility causes trouble, the metal drags easily, and tears and gouges. However the graphite flakes in gray iron break up the continuity so that a gray iron, all ferrite and graphite, has no more true ductility than an iron composed of graphite and pearlite. Incidentally, malleable cast iron is all ferrite and graphite.

However the graphite in malleable cast iron is in nodular form, not in flakes, as in gray iron. Extensive laboratory machining tests by H. A. Schwartz indicate that machinability increases with increasing graphite content. Irons high in ferrite, hence low in combined carbon, machine most readily, other factors equal. However, under ordinary casting conditions high ferrite often indicates open grain and low strength. Exceptions to this will be mentioned later.

The phosphorus in gray iron is found in the formation known as steadite. This component, not necessarily of constant composition, is found distributed throughout the matrix. If sufficient in amount it has a decided tendency to form network structures as shown in Fig. 113. At 0.20 to 0.30 per cent phosphorus that tendency is not marked but at 0.50 or 0.60 per cent phosphorus and over it usually is quite marked. Steadite is hard and abrasive. Stead has shown that eutectic steadite has a Mohs' (mineralogical scratch) hardness of 5.5, which closely approaches the hardness of quartz sand.

Hence, it is an extremely abrasive component and under certain conditions detrimental to easy machinability. It should be remembered that 1 per cent of phosphorus gives about 10 per cent steadite by volume. MacKenzie has pointed out an iron containing 4.8 per cent phosphorus (not a white iron) which had a brinell hardness of 418. In Fig. 113, the hardness of steadite is demonstrated by relief polishing. The harder steadite stands out in relief above the background. The hardness of steadite may be demonstrated readily by drawing a needle across a sample etched for microscopic investigation, as pointed out by Bolton, THE FOUNDRY, June 1, 1926.

Phosphorus Lowered Machinability

On examining with the microscope the scratch across the steadite will be narrower than on the rest of the metal, this indicating the hardness of the phosphorus rich crystal. Bolton says further—"In strong irons the phosphorus formation steadite, acts as an abrasive. It greatly lowers tool life, and hence lowers machinability. The tiny hard steadite crystals destroy the tool edge quite rapidly. The author has confirmed this in a number of instances. In two instances, on widely variant classes of castings, strong iron was made (commercially) *unmachinable* by phosphorus being raised from 0.30 to 0.60 per cent. Other conditions equal, in another instance, a firm was enabled to machine low phosphorus high test metal successfully where before it had been unable to use high test metals of higher phosphorus.

"In low strength irons the abrasive effect of phosphorus is not so marked and in fact it may be negligible. The abrasive crystals are held in a softer backing of matrix, and are pushed out of the way, in machining."

An exception to this may be in irons of good tensile properties obtained by a low amount of finely distributed graphite in a highly ferritic matrix. In that case it might be possible to use higher phosphorus without serious loss in machinability.

This is the seventeenth article of a series on the engineering properties of gray iron. The sixteenth appeared in the May 1 issue of THE FOUNDRY, and the eighteenth will appear in an early issue.

THE EDITORS

Jeffrey Mfg. Co., Columbus, O., has opened a direct factory branch office at 602 Esperson building, Houston, Tex., Thomas J. Burke has been appointed district sales manager in charge of all products.

Power Rate Influences

Electrical Equipment and Melting Costs

By Ottomar H. Henschel

EVEN though the average industrial executive is convinced that under existing conditions the purchase of electric energy may be cheap, he does not realize the vital importance attached to the rate of purchase and the mode of plant operation employed. Statistics in the files of many engineers reveal that unless electric energy is purchased at the most favorable rate and is used in the proper manner utility company charges frequently are considerably higher than the cost of a like amount of energy if locally generated.

In the purchase of electric energy, especially that applicable to industrial plants, many factors other than rate per kilowatt hour quoted enter into the ultimate charge. Due consideration always must be given to such elements as demand, power factor and in some instances a *coal factor* which may be a deduction or addition depending upon the cost of coal to the serving utility.

Rate Governs Profit

It is important that the foundry executive make, or have made by a competent engineer, a careful study and investigation of his power charges for upon them may hinge the high or low cost per ton of metal produced. Profit or loss to the plant may depend upon that single item of overhead.

What may be accomplished in that respect was revealed recently in the case of a midwestern malleable iron foundry. That plant was dependent upon the local public utility company for its electric energy. The foundry's power costs were excessively high because the energy was purchased under unfavorable conditiones and disadvantageous rates. The electric energy cost per ton of metal melted was high. Those facts were revealed by a general investigation of conditions as they originally existed.

The initial investigation consisted of a comparison of the existing rate under which the energy was purchased with other rates which were available to consumers under like conditions. The foundry had been paying for electric energy under what is termed an increment rate. Comparisons were made with the unlimited-primary-metering and off-peak-primary-metering rates. Costs involved in making the necessary changes also were studied. Under the original rate, all transformer, switching and protective equipment was supplied by and remained the property of the utility, while under either of the other two rates, the consumer had to provide and maintain his own substation. In the latter case, the proper way to attack the problem is to make a comparison with past performances. That was done. A study of the monthly tonnage, kilowatt-hour consumption, unit cost, total net cost and cost per ton of iron melted for a two and one half year period extending from January 1924 to June 1926 inclusive was made. Those figures were compared with costs which would have existed if the plant had been operating under either the unlimited-primary-metering or the off-peak-primary-metering rate, and the resulting respective reductions in net costs were obtained. The results are shown graphically in Fig. 1.

For the two and one half year period under consideration, the minimum monthly consumption of energy, 9,900 kilowatt-hours, occurred during July 1924 while in September of that same year the maximum consumption, 34,300 kilowatt-hours, was used. In the former case the net cost under the existing rate was $312.58. However, under the unlimited-primary-metering rate and would have been $418.52, an increase of $105.94, and under the off-peak rate $270.02, a decrease of $42.56.

On the other hand in the case of the maximum consumption of 34,300 kilowatt hours, the net cost was actually $976.87, which under the unlimited-primary-metering-rate would have been $706.66, a reduction of $270.21 and under the off-peak rate $558.16, a saving of $418.71.

It is evident that with the minimum consumption it would have cost $105.94 more to be under the unlimited-primary-metering rate and only $42.56 less under the off-peak rate, while the net savings based upon existing costs under consumption conditions of 34,300 kilowatt hours would have been 27.6 and 42.8 per cent less under the unlimited and off-peak-primary-metering rates, respectively.

Table I

Possible Savings

Iron melted	5,928.6 tons
Electric energy consumed	606,000 kilowatt hours
Net cost at existing rate	$17,800.86
Net cost under unlimited-primary-metering rate	16,357.14
Resulting reductions	1,443.72
Net cost under off-peak rate	12,004.41
Resulting reductions	5,796.45
Average approximate yearly saving possible by employment of unlimited primary metering rate	577.48
Average approximate yearly saving possible by employment of off-peak rate	2,318.58

Paid Too Much

Summarizing the cost of the year 1924, the foundry had paid a total of $7,720.38 for energy which under the unlimited-primary-metering rate would have cost $6,798.05, a reduction of $922.33, while under the off-peak-primary-metering rate, the net costs would have amounted to $5,019.55, a saving of $2,700.83. In like manner, the net costs for the year 1925 were $6,854.63. Under the unlimited-primary-metering rate, they would have been $6,433.20 and under the off-peak rate $4,650.97, reductions of $421.43 and $2,203.66 respectively. For the first six-month period of 1926, reductions under the unlimited-primary-metering rate would have been equal to $99.96 and under the off-peak rate $991.96.

Considering the entire period of 36 months from January 1924 to June 1926 inclusive the figures in Table I show the possible savings.

When the management was presented with those figures, no doubt regarding the advisability of making a change remained. However, at the time it was not desirable to invest in the equipment required and, after negotiations with the utility company, arrangements were made whereby the latter company agreed to rent the substation equipment to the consumer at a nominal charge.

To secure the maximum benefit of the best rate available, the off-peak-primary-metering rate, it was necessary in the locality under discussion that the consumer refrain from using any energy except that actually re-

quired for plant and office lighting during the following hours from October to March inclusive of each year.

Month	Hours During Which Service Shall Not Be Used A.M.	P.M.
October	5:30 to	7:00
November	5:00 to	7:00
December	4:30 to	7:00
January	4:40 to	7:00
February	5:20 to	7:06
March	6:00 to	7:00

When this schedule was first presented considerable opposition arose from plant executives, particularly the superintendent and foremen. However, after study of local conditions, an exceedingly convenient program of plant operation was worked out and maintained.

Power Factor Corrected

If the consumer is to derive the greatest benefit under the unlimited-primary-metering or the off-peak-primary-metering rates, it is necessary that he maintain his system's average monthly power factor as near 100 per cent as possible. For every degree of power factor less than 100 per cent, he is penalized automatically.

In this particular plant, the system's average monthly power factor ranged from 55 to approximately 59 per cent. The management desired to eliminate the low power factor and reduce the net cost of purchased energy. A survey was conducted which revealed an over-motored condition in the plant. That condition was the fundamental, if not the entire, cause of the low power factor.

Where possible motors were shifted bringing as many of the driven pieces of equipment to their proper state of motorization as was practicable. A few larger motors remained on hand. Those were traded advantageously for units of smaller sizes. No wiring changes were required in the remotorization program and for that reason, wherever a change was made, a smaller motor always was substituted for one of larger capacity. Upon completion of the remotoring, it was found that the system's average monthly power factor had risen to slightly above 80 per cent, the maximum which could be reached purely by remotorization.

The advisability of bringing the system's average monthly power factor to as near unity as possible was considered. From an engineering standpoint, that could have been done readily by purchasing a static condenser. However, from an economic point of view, it was found that the expenditure for corrective equipment to secure a further reduction in costs by bringing the system's power factor up from 80 to 100 per cent would not have been warranted.

Expansion of plant activities necessitated the purchase and installation of another air compressor. That resulted in a substantial addition to the connected plant load. With the increased power required, it became evident that the existing transformer capacity would not be sufficient to care for the added demand. The local utility company was reluctant about either extending its lease on the existing equipment or installing larger transformers to meet the new requirements. As a consequence, the foundry management arranged for the purchase and installation of its own substation. The existing substation equipment consisted of two, 100 kilovolt-ampere, three-phase, transformers connected in parallel providing 200 kilovolt-ampere capacity.

Table II

Substation Cost

Steel substation structure with required grounded air-break switch, fuses, insulators, choke coils, wiring, etc.	$1,134.70
Two 200-kilowatt-ampere, 26,400-volt primary to 220-440-volt secondary single-phase sixty-cycle, oil-insulated, air-cooled, outside type transformers	1,724.00
Three, Pellet type lightning arresters	225.75
Station fencing	490.00
Concrete work	600.00
Labor	500.00
Total	$4,674.45

Describes Installation

After due consideration it was decided to have designed and installed an outdoor substation employing two, 200 kilovolt-ampere, single-phase, transformers, connected by the open delta method. That arrangement provided the plant with 344 kilovolt-amperes. The company allowed for further expansion and the ultimate scheme will consist of an additional 200 kilovolt-ampere transformer making the final capacity of the substation 600 kilovolt-amperes.

The substation as built is shown diagrammatically in Fig. 2. Energy is supplied at 26,400 volts, three-phase and the voltage is stepped-down to 240 volts for distribution throughout the foundry. The station is protected from lightning by three, pellet-oxide-film type, lightning arresters which are mounted on a pole immediately outside of the station.

That type of arrangement was employed to conserve floor space. Directly following the lightning arresters are three 100-ampere, 37-kilovolt, strain-type, choke coils with bird guards, anchored to the structural steel work by strain insulators. The

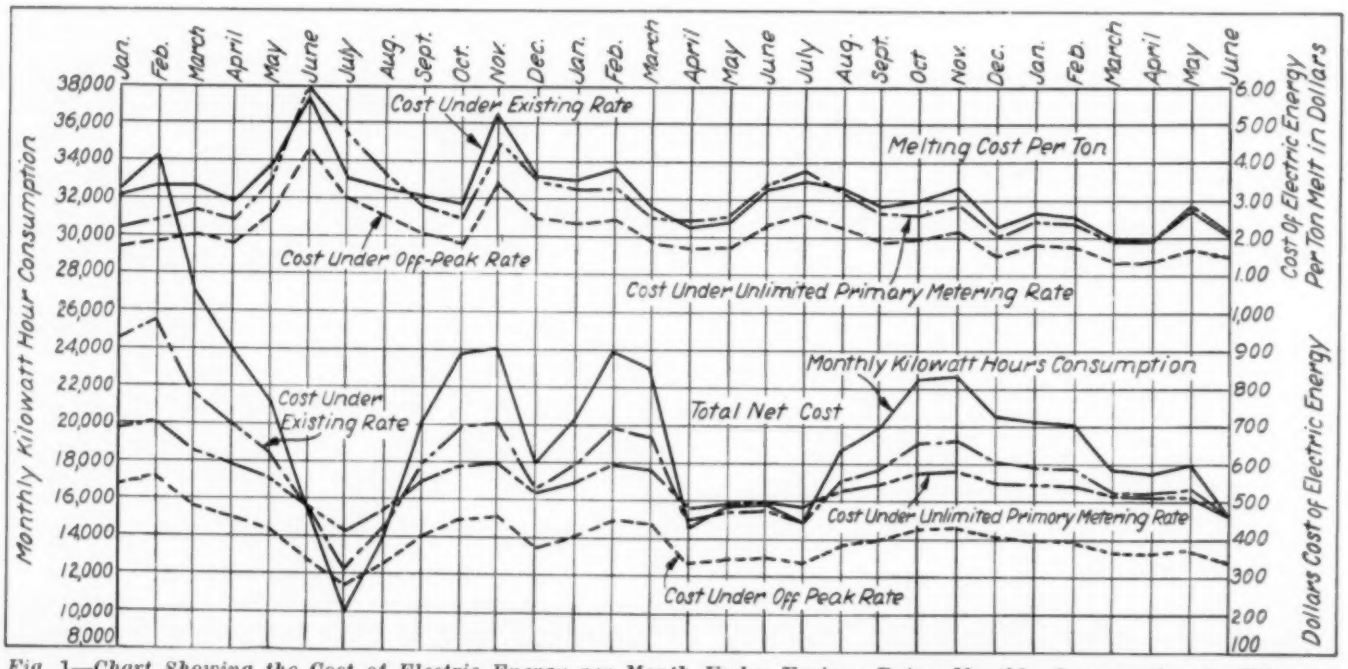


Fig. 1—Chart Showing the Cost of Electric Energy per Month Under Various Rates, Monthly Consumption in Kilowatt-Hours, and Cost of Power per Ton of Iron Melted as Influenced by Three Different Rates

lead from the strain insulator side of the choke coils connects with a 37-kilovolt, 300-ampere, 3-pole, single-throw, vertical, air break switch. That switch is fitted with sleet guards and arranged for manual gang operation by a suitable mechanism terminating in an operating lever located at the side of the structure and within easy reach of the ground.

A grounding switch is built integral with the air break switch. That allows immediate groundings of the station's electrical equipment on the consumers side, in the event that the main switch is open.

Cost of Installation Shown

The main wiring of the station is made up of No. 0, hard-drawn, copper wire which connects the main air break switch to a set of disconnecting fuses. Those fuses are connected in turn by the same sized leads to the transformer primaries except for by passes leading to the metering transformers. The structure of the substation is built of galvanized iron angles, and rests on concrete footings. Approximately 2600 pounds of structural steel were required for this unit. Rust proof bolts, nuts and washers were used in the assembly to prevent rust and corrosion.

Many times utilities sell and install substations. However, in many cases, it has been possible for the industrial plant to do that work itself at a considerable saving with its own force of capable electricians and by the direct purchase of the equipment. The detailed cost of the substation under consideration with the initial, two, 200 kilovolt-ampere transformers is shown in Table II.

The motor supplied with the air compressor referred to previously was of the slip-ring type. It was decided to change that installation because that unit was of insufficient capacity to provide the required air-pressure. Rather than purchase another slip-ring type motor, it was found more expedient and economical, to employ a synchronous motor of a capacity that would provide sufficient power factor correction to increase the system's average monthly power factor to 100 per cent.

Since installation and operation of that equipment the power factor of the plant system has been maintained at 100 per cent. The corrective characteristics of the apparatus were such that manipulation of the field current was necessary to prevent the establishment of a leading power factor.

As a result of the changes in rates and equipment, service has improved, production interruptions have been eliminated practically and costs have been reduced materially. Electric energy cost, regardless of consumption, has been reduced approximately 47.7 per cent.

Table III

Power Factor Effects

Energy consumption	38,500 kw. hr.
Measured demand	170 kw. hr.
At 60 per cent power factor	
Billed demand = $\frac{170 \times 80}{60}$ = 226.6 kw.	
Demand charge:	
200.0 kw. @ $1.00	200.00
26.6 kw. @ .75	19.95
	$219.95
Energy charge:	
25,000 kw. hr. @ 1.25c	312.50
13,500 kw. hr. @ 1.10c	148.50
Total gross	$680.95
Prompt payment discount	7.80
	$673.15
Coal factor deduction @ .1212c per kilowatt hour	46.66
Net billing with 60 per cent power factor	$626.49
At 100 per cent power factor this billing would appear as	
Billed demand = $\frac{170 \times 80}{100}$ = 136 kw.	
Demand charge:	
136.0 kw. @ $1.00	$136.00
Energy charge—as above	461.00
Total Gross	$597.00
Prompt payment discount	6.97
	$590.03
Coal factor deduction — as above	46.00
Net billing with 100 per cent power factor	$543.37
Saving	83.12

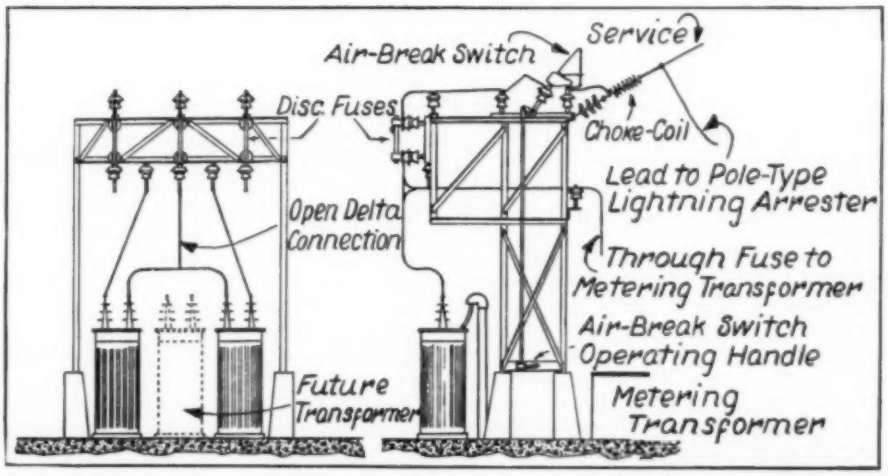


Fig. 2—Layout of Substation Showing Method of Connecting Transformers, Switching and Protective Equipment

Pittsburgh Group Meets

Foundry costs were considered at the regular monthly meeting of the Pittsburgh Foundrymen's association, held May 18, at the Fort Pitt hotel. J. E. Currie, Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa., described a method for determining foundry standard costs and led the discussion on the subject. About 40 members of the association attended the meeting.

Election of officers for the ensuing year also was held, confirming the selection of the nominating committee presented at the April meeting. New officers are: President, H. F. Seifert, Westinghouse Electric & Mfg. Co.; vice president, T. A. Reynolds, McConway & Torley Co.; secretary-treasurer, W. J. Brant.

Book Review

Life Expectancy of Physical Property, by Edwin B. Kurtz, 205 pages, 8 x 6 inches, cloth, published by the Ronald Press, New York, and available from THE FOUNDRY, Cleveland, for $6.00 plus 15c postage, and in London from the Penton Publishing Co., Ltd., Caxton House, Westminster, for 30s, postage extra.

Principles and methods successfully used by life insurance actuaries in dealing with human mortality have been applied to physical property by the author. Though data for the computation of physical property mortality in many cases are difficult to obtain, the methods apply even better than to human life. The book presents a wealth of such data gathered by the author over a period of 14 years of research and analysis. This information is analyzed according to scientific principles and is used as a basis for dealing with the problems that arise in connection with valuation of industrial property.

Engineering and accounting aspects of depreciation and obsolescence are combined and a working method for their determination outlined. Necessary data are presented in carefully organized, tabular form. Useful life expectancy, renewals, and other valuable information are included. The volume is illustrated freely with charts and diagrams, all of which are explained fully in the text. The material should prove of considerable value in eliminating guess work, and is a useful tool for the executive, engineer, or accountant faced with the depreciation problem.

Philadelphia Steel Abrasive Co., with a plant and office at Frankford, Philadelphia, Pa., recently has equipped a complete plant for the production of steel abrasives.

Prevent Losses With Proper Gates and Risers

By Pat Dwyer

THE term skimmer gate, usually shortened to skim gate is applied promiscuously in the foundry to any type of gate, runner or pouring basin in which any form of device is incorporated to prevent foreign material from flowing into the mold with the molten metal. Every skimmer is based on the well known fact that slag, or a compound of slag and sand, is lighter than iron and therefore will be found floating on top of the stream. The skimmer is designed to stop the slag.

Lock the Stable Door

A skimmer gate of any type, as indicated previously, is the last precaution taken by the founder in his effort to produce a perfect casting. Unfortunately, in many instances, this skimming gate is a futile gesture and simply is another one of the many variations of the classic performance known as locking the stable door after the horse is stolen. To bring the simile up to date, probably it should be changed to locking the garage door after the slicker has departed with Our Liz. Ancient or modern, the meaning is the same. Unless the mold is perfect in every other particular, the most efficient and perfect skimming gate, will not save the casting from the scrap pile. It is equally certain in many instances that unless a proper skim gate is provided, the most perfect mold will not yield a perfect casting.

This feature has been touched upon, before, but it cannot be emphasized too strongly or mentioned too often. From lack of actual experience, rising young foundrymen do not realize the importance of this feature. Older foundrymen in many instances are bound by tradition and custom and do not favor any change in gating methods to which they have been accustomed. Others again, lack imagination, or perhaps it is more accurate to say have not that peculiarly ingenious type of mind which enables a man to visualize in advance the result of an experimental performance.

Many men, at times, entertain apparently radical ideas in connection with the molding and gating of certain castings, but they are prevented from carrying out the ideas either by their own timidity, or through failure to obtain the sanction of their immediate superiors.

Authority carries responsibility and responsibility usually begets conservatism in some men hitherto immune, while it intensifies that attribute in those to whom conservatism is a natural heritage. No person can quarrel with conservatism, intelligent conservatism based on knowledge and experience. It serves as a brake on enthusiastic but over ambitious amateur effort. However, when carried too far it may act as a brake on actual and necessary progress.

Take the Credit

Another type of man constantly is on the alert for changes and improvements in anything pertaining to his business. His mind is open to new impressions and he is willing to weigh the merits of a feature impartially even to the extent of giving it a work out in actual practice. The majority of men of this type freely admit the source of their information. They give full credit to the person who originated the idea, to the person who brought it to their attention, or to the place where the idea was in practical application.

A comparatively small number—the secretive type—calmly adopt methods, processes and shop kinks originated by others and boldly proclaim them as their own brain children. However, this form of idiocincrasy is not confined to the foundry industry. Practically every person in all walks of life has encountered instances in his own experience.

The foregoing preamble or digression is prompted by a consideration of the methods employed in gating large flat plates. The usual method, a number of branch gates at the sides or ends, is open to criticism from a number of points on ordinary castings. It is seldom or never satisfactory on castings which have to be machined on the cope side. The only points that can be advanced in its favor are its extreme simplicity and the fact that it has been employed almost universally over a long period of years.

Iron Is Poured Fast

So far as simplicity is concerned, the foundryman might reflect with profit on the fact that he is selling the casting and not the gate. Saving 50 cents in the prepartion of the gate and losing $20 on the casting is not conducive either to the foundryman's reputation or his bank account.

In certain circumstances, age, custom and tradition may invest a person, object or method with a halo little less than sacred. However these factors are not always infallible. Sometimes they merely indicate a state of passivity, a condition which is borne until something better appears. The horse and the rubber tired buggy was quite an institution a few years ago. The rising generation does not know whether the buggy was mounted on two wheels or on four, or whether the horse traveled on hay or gasoline.

Many liberties can be taken with thick plates of large area that are not permissible with plates of equal area but thinner in section. Iron solifies rapidly on a large flat sand bed

Gate for Large Plate

USUAL methods for gating and pouring large plates are faulty in many respects, despite the fact that they are practised almost universally and have been in use for a long period of time. The principal objection to the usual type of gate is that it does not distribute the metal in a manner conducive to uniform cooling speed and in that manner sets up strains that cause the casting to warp. The only positive type of gate and runner for a plate that has to be machined on the cope side is described and illustrated. Metal is poured through a number of pop gates spaced equidistantly on the top of the casting. Evidence is advanced to show that the practice of covering risers is unnecessary in nearly all cases.

and naturally the process is much more rapid in a thin plate, than in one where the heavy body of metal retains the heat longer. Consequently the molten iron must be rushed into a thin plate with the greatest speed. This practice involves a corresponding strain on the upper and lower faces of the molds, an increased erosive action in the sprue and gates, danger of cold shuts and uneven thickness.

Each or all of these undesirable features are accentuated by the usual method of gating employed on plates, whether thick or thin. The danger is not so acute on thick plates where the metal may be poured at a slightly lower speed and where the streams have an opportunity of meeting and mingling to form a homogeneous mass.

Theoretically, a large plate, for example 6 x 8 feet and ¾-inch thick, should be gated at both sides and both ends to insure rapidity in filling and consequent uniformity in cooling. Also to distribute a uniform strain on all the clamps holding the cope and drag together, or, on the weights, in the event that the casting is molded in the floor and the cope is held down in that manner.

A little practical difficulty in handling four ladles simultaneously induces the foundryman to view the method with disfavor. Even while willing to admit its superiority he passes it by and decides to risk the more hazardous method of pouring all the iron through one or perhaps two sprues connected by a long runner at the joint to a number of branch gates leading intot the mold.

In some instances the runner is not more than 2 feet in length, while in others it may extend any distance up to the full length of the casting, depending on the personal whim of the molder, or whoever is directing operations.

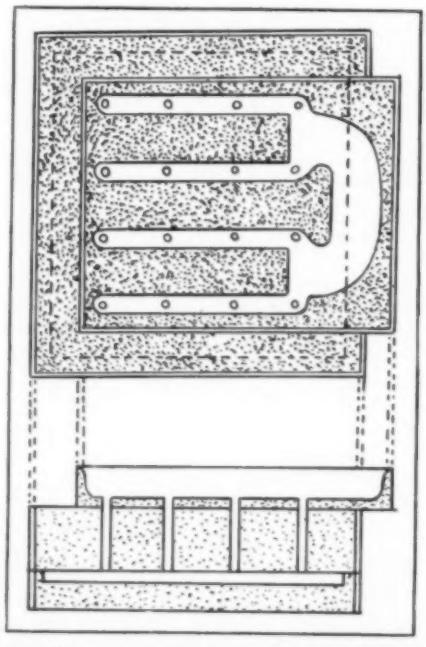


Fig. 45—Approved Method of Gating a Large Plate

Manifestly, iron poured into a mold in that manner will not fill the mold in anything like a satisfactory condition. Marked variation in temperature will obtain at opposite edges and particularly at corners of the plate. Even if the metal does not force a passage at the joint behind the gate in the cope and drag, it will exert sufficient pressure on the sand to cause a variation of thickness in the casting at the far and the near sides.

Difference of metal thickness in a plate and consequent variation in the cooling speed in different areas will cause the casting to warp. This point frequently is overlooked in the post mortem held on a crooked plate. Various remedial measures are proposed and carried out in an effort to overcome the difficulty, when in reality all that is required is an intelligent application of a proper gating system.

Plates Will Warp

So far as distribution of metal is concerned a set of branch gates on all four sides is satisfactory, but as pointed out in a preceding paragraph, this method involves the use of four ladles and the use of a flask greatly in excess of the size of the plate. The temptation to use a smaller flask prompts the molder to skimp on the margin of sand between the runner and the side of the flask. This mistaken form of economy obtains even in instances where the plate is poured from one side and the result is that the additional pressure forces the cope and drag apart and the iron runs out.

The average molder fails to realize the tremendous pressure exerted by liquid iron spread over a large area and under a high head. Bearing in mind that the pressure is equal to the displacement and that a square foot of cast iron 1-inch thick weighs 37.5 pounds, it is apparent that a plate 6 x 8 feet, 1-inch thick, poured under a 10-inch head will exert a pressure of 6 x 8 x 37.5 x 10=18,000 pounds, or 9 tons. Manifestly a mold of that kind must be clamped securely, or weighted down adequately to resist this tremendous pressure. The casting itself will weigh only 1800 pounds and for that reason the molder finds difficulty in realizing that a weight of 9 tons is required to hold down the cope on the mold.

Where the mold is made between a good, stiff cast iron or steel cope and drag, the danger of a runout is greatly minimized. Heavy clamps tightened with cast iron or steel wedges usually may be relied upon to hold the two parts of the mold totgether. Wood wedges will yield in extreme instances.

Fear of a runout on the gate side of a large plate molded in the floor prompts the molder to bank sand up

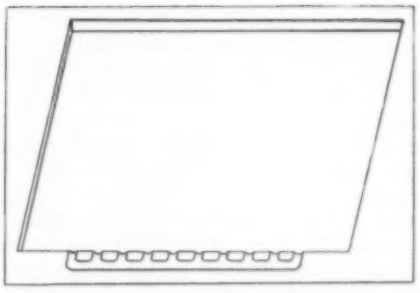


Fig. 46—Usual but Faulty Method of Gating a Large Plate at One Side

against the outside of the cope on that side and to reinforce the bank with pieces of pig iron. In some instances the dam holds, but if the cope lifts to any apreciable extent the iron bursts forth and creates the liveliest excitement while men throw additional sand, pig iron and water on the boiling volcano.

Occasionally the casting is saved, but usually it is a waster despite the heroic but mistakenly adopted salvage measures. A reasonable margin of sand behind the runner, rammed to the proper density in the cope and drag, and adequate weight on the cope will prevent a runout and insure a casting of uniform thickness.

The best method of gating a large plate, a method that practically is mandatory where the casting has to be machined on the cope side, is shown in Fig. 45 where 16 small pop gates are spaced equidistantly over the surface and are supplied with metal from four main runners connected to a single pouring basin on top of the cope.

Making up this set of pouring basin and runners involves a little extra work, but it is a guarantee of a clean plate, flat and straight and of uniform thickness. The actual number of pop gates and their size will depend on the area of the plate. The illustration shows a typical gating arrangement for a plate 7 x 7 feet. The pop gates are ¾-inch diameter at the top, tapered to ½-inch at the bottotm where they open into the mold.

Where a small piece of tin is placed over each opening in the runner, the first dash of metal will carry any dust or small particles of loose sand to the far end before the metal begins to sink through the gates. Additional metal will keep any foreign material floating on top of the runners until pouring has ceased. A small riser on each corner of the casting will serve as an indicattor when the mold is filled. The man handling the ladle then can reverse the wheel and avoid flooding the basin and runners. By careful manipulation and a close watch on the smoke rising from the risers, he can arrange to have practically no iron left in the runners when the mold is filled.

The practice, widely observed, of looking directly down into a riser to gage the progress of the metal rising

in the mold, is not only unnecessary, but in some instances actually is dangerous. In every instance the heated air is driven upward with considerable force and at a temperature sufficient to scorch the skin. Usually, also, the practice is unsatisfactory, particularly in molds in which the facing sand contains coal or where the blacking on the face of the mold is of a highly combustible character. The smoke coming up through the riser obscures the vision and the rising column of iron is not detected until it is too late to be of any service as an indicator to the man pouring the iron from the ladle.

With a little practice a man can stand at a safe distance and gage the rise of iron in the mold by the behavior of the smoke coming out of the riser. In the beginning only a thin wisp of smoke will show. This will increase in speed and volume until the mold is nearly filled with metal. Just before the metal enters the riser the column of flame or smoke or both. will drop sharply. That is sufficient indication for the ladle man to ease off on the stream, or stop altogether, depending on the amount of metal in the pouring basin.

Throws Jet of Flame

The foregoing refers to the normal mold in which no disturbance takes place and where the metal merely displaces the air. Commotion caused by steam and gas in molds that are made improperly, throws such a wild jet of flame through the riser, that no person can go near it. In extreme cases disintegrated molten iron is incorporated in the jet and that feature effectually bars any person from peeping down the riser. Usually a casting of that kind is a waster, but occasionally it is saved by pouring iron slowly until the commotion ceases. In the vernacular of the foundry, this is known as "touching her up."

Observation of this phenomenom, or, perhaps to be more accurate, partial observation of this phenomenom, has divided foundrymen into two main schools of thought. One believes that all risers should be covered. The other is firmly convinced that no risers should be covered during the pouring process. A comparatively small number of foundrymen remain on the fence. They claim that in the majority of instances the risers with perfect propriety may be left open, but under certain conditions they should be covered.

Belief or faith in anything is not necessarily based on proof. In fact true faith means the acceptance of a statement, a dogma, or a doctrine without proof. This is as true in the foundry as it is on the outside. Members of the covered riser school are members because in their young days, they were taught that the covered riser was essential to success. They accepted the statement of their predecessors or teachers and never troubled to carry on any investigation on their own account to test its accuracy.

Extent to which custom governs the practice in any given plant easily may be determined by visiting two foundries in neighboring districts. In one the visitor will find that every riser is covered carefully, while in the other all brazenly are left open. The castings made in one foundry do not differ from those made in the other.

Adherents of the covered riser defend their belief by the statement that the imprisoned air helps to maintain

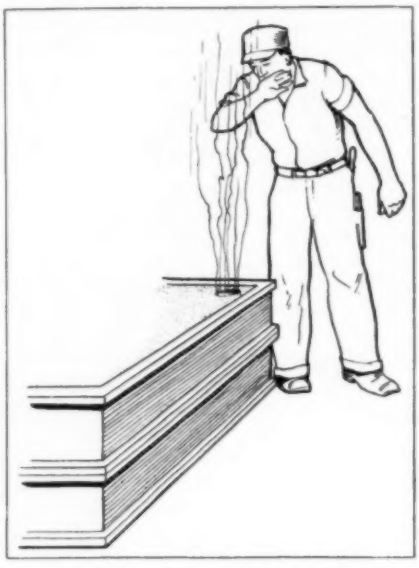


Fig. 47—Workman Risks Loss of His Eyes Attempting To Peer Down Into a Riser

intact the side and cope faces of the mold. They claim that under an open riser the rushing current of air may play havoc with the face of the mold.

A thoroughly impartial, unbiased investigation of the subject should convince any person that building up air pressure in a sand mold is about as feasible as trying to build it up under a ½-inch riddle. The air escapes as fast, but no faster, from a tightly closed mold as it does from one with a great, open riser. The current of air that comes from a riser only attains any speed when it enters the riser and becomes constricted. While in the mold its movement is negligible.

Evidence of violent commotion in an ill made mold will show in an open riser. A covered riser will conceal that evidence and—as stated previously—the commotion may cease before the metal solidifies. The molder assumes that the casting is perfect because he saw no evidence of disturbance while pouring the metal into the mold.

As a plain matter of fact it may be stated that in the majority of instatnces, no riser of any kind is necessary. Where a riser is needed to serve as a feeder, a showup or a flowoff, it is perfectly immaterial whether it s covered or uncvered. Therefore why go to the trouble of covering them?

This is the tenth of a series of articles dealing with the various types of gates and risers used in the foundry industry. The eleventh will appear in an early issue.—THE EDITORS.

Institute of British Foundrymen To Meet

The twenty-eighth annual conference of the Institute of British Foundrymen will be held in Birmingham and Coventry, England, June 9 to 12. Headquarters of the meeting will be in Birmingham, but on June 11, the sessions and social events will take place at Coventry, the home city of president-elect, Andrew Harley, Daimler Co. Ltd. The Institute of British Foundrymen originally was formed in Birmingham, and conferences were held there in 1909 and 1922. Members attending the conference will have an opportunity of seeing the widely divergent foundry activities in the Midlands through plant visitations.

The conference will be opened June 10, by F. P. Wilson, president, Pease & Partners Ltd. Technical sessions will take place on the mornings of June 10 and 11, while the afternoons will be devoted to plant visitations. The annual banquet will be held on the evening of June 10.

Nine papers will be presented at the meeting. During the morning of the first day two sessions will be held, one of which will be devoted to the official exchange papers, which are as follow: "The Effect of Elevated Temperatures on Gray Iron Castings," the American exchange paper, by G. W. Spring, Chicago; "Factors in the Conductivity of Irons," the Belgian exchange paper, by Prof. H. Thyssen, University of Liege; "The Laboratory and the Foundry," the French exchange paper, by M. Arzens. In addition, a paper by Eric N. Simons, Edgar Allen & Co. Ltd., Sheffield, entitled "The Merchandising of Castings," will be presented.

Concurrently with this session, another will be devoted to the following papers: "Sands and Sand Testing," by J. G. A. Skerl, British Cast Iron Research association; "Silicon As an Alloying Element," by John Arnott, G. & J. Weir Ltd., Glasgow; and "High Duty Light Alloys," by W. C. Devereux, High Duty Alloys Ltd., Slough.

The following papers will be presented at the morning session June 11: "The Relationship Between the Engineering and the Foundry Trades," by L. H. Pomeroy, Daimler Co. Ltd., Coventry; and "Recent Developments in Cast Iron in Great Britain," by J. G. Pearce, British Cast Iron Research association.

Questions & Answers on FOUNDRY PRACTICE

GENERAL

Wants Book on Loam

I should like to have a book on loam molding practice, if possible one of recent issue. I am fairly familiar with the subject, but I should like to have more complete information. We have an order for some 48 and 54-inch Y and T pipes with bells on all three openings and I do not see clearly how the bricks are to be supported in the copes.

So far as we know, no book ever has been published devoted exclusively to the subject of loam molding. Of course this is due to the fact that the demand would not be sufficient to justify the cost of publication.

In the late Thos. D. West's *Molder's Text Book* and *American Foundry Practice* several excellent chapters are included on loam molding. Unfortunately both these books now are out of print, but it is quite possible that you may find copies in the public library of your city.

THE FOUNDRY frequently has presented articles on loam molding practice. A comprehensive series of nine articles ran consecutively in the issues from Dec. 1, 1925 to April 1, 1926. Bound volumes of THE FOUNDRY for these years probably also are available in your city library. If you have a back copy of THE FOUNDRY for Oct. 15, 1930 you will find on pages 54-58 an illustrated article describing the methods employed in a prominent southern foundry for molding large pipe shapes and other castings in loam molds.

If you have large iron flasks available, also crane service and oven space, you may find that the castings can be made as readily and economically in dry sand molds. A lifting plate around the bottom of the cope will eliminate the expense of making special bars for each cope. Plain bars extending down to the top of the pattern will hold the top with gaggers only required over the arches. The cope, as in loam practice, is not rolled over. It is finished overhead. The only pattern equipment needed for the pipe is a templet to lay on the joint of the drag and a few sweeps or strikes.

THIS department covers all problems relating to metallurgical, melting and molding practice encountered in making steel, malleable-iron and gray-iron castings. Questions submitted by bonafide subscribers to this department will be answered by members of the editorial staff of The Foundry, supplemented where occasion requires by the advisory staff whose personnel is as follows:

John H. Hall
Cast Steel

H. A. Schwartz
Malleable Cast Iron

J. W. Bolton
Gray Cast Iron

All questions must be addressed to the Editor, The Foundry, Penton Building, Cleveland.

Q & A

Tests Cast Gas Pipe

We make gas main connections for a local company serving this community. Recently the engineers of the gas company decided that all these castings must pass a soap-water test with air at 35 pounds pressure. This test is new to us and we shall appreciate any information on the devices employed for testing standard fittings from 4 to 12 inches diameter, including reducers bends, crosses, tees, etc., all bell and spigot type.

The so called soap-suds test is not part of the regular routine testing system practiced at any of the plants where pipe and fittings are made. Occasionally a customer calls for this test and when that happens, a temporary rigging is improvised for the purpose. The test may be applied according to either of two methods. In the first the closed pipe is painted with soapy water and then subjected to air pressure from within. Leaky areas manifest themselves by the presence of soap bubbles on the outside surface. In the second method the pipe is filled with soapy water and then the water is subjected to air pressure. The presence of a leak of any kind is detected as in the former instance by the formation of soap bubbles in the vicinity. Where only a small number of fittings 4 to 12 inches are to be subjected to the soap water test, blank flanges may be caulked in the ends. For large quantities a hydraulic testing machine quickly would pay for itself. Some of these machines are piped for two lines, one for water and the other for air.

Q & A

Sand Roughens Surface

I am forwarding for your inspection a piece of iron cut from one of our castings made on a conveyor system. The sand is put through a muller before entering the bins. It shows a permeability of 65 to 85, green bond compression 6 to 8 pounds, moisture 4 to 5 per cent. This sand makes a neat mold, draws well, but it burns on to the face of the casting, prolongs the cleaning time and leaves a rough finish. We do not add any new sand to the supply. Return cores from the shake-out keep it open. Bond is maintained through the addition of a proprietary clay. No sea coal is used.

One of the most aggravating features of foundry practice is that the sand which makes the most perfect mold from manipulation and appearance viewpoint, does not always make the most perfect casting. In fact the same features which produce perfection of detail in the mold, bond, moisture and small grains, produce an adverse effect on the face of the casting. The foundryman has a constant battle on his hands to maintain a balance between the appearance of the mold and the appearance of the casting. In your particular case the

fusible impurities in the sand are too high. By a process of elimination you can determine whether this condition is due to the original composition of the sand, or to the addition of an excess amount of bonding material. Temporary relief may be had by using sea coal facing over the patterns, or even by placing a little sea coal facing in the pockets and corners. The flat surfaces will peel if the mold is dusted with blacking or sprayed with a mixture of blacking and gasoline. However, for permanent relief, a more refractory sand will be necessary all through the system.

Q & A

Figure Casting Loss

A modernly equipped foundry producing cast iron pipe fittings up to and including 6-inch sizes shows a yield of 71.2 per cent good castings over a 3-year period. This report is based on weight of iron melted. Does this represent good foundry practice?

A 71.2 per cent yield of good castings in the field to which you refer reflects excellent foundry practice. Metal in the gates and risers amounts to approximately 25 per cent. Melting loss, that is the amount of metal which actually disappears during the melting process, amounts to at least 2 per cent. This leaves only 1.8 per cent chargeable to defective castings. The actual amount in gates and defective castings may vary to some extent from the foregoing, but the net result, 71.2 per cent good castings, percentage based on the weight of metal charged, is quite satisfactory.

Q & A

Clay and Cement Used

Dry sand cores are made with binders of a linseed oil base, pitch, rosin, cereal, etc. All of these are hydrocarbons. Can you tell us what core binders have been used that are not hydrocarbons and what results were obtained?

So far as we know there are only two binders which do not come under your classification of hydrocarbons or organic compounds and these are clay and portland cement. However, clay due to certain properties seldom is used alone as it decreases the permeability of the core. Usually clay is used in combination with molasses, glutrin, and in Europe with horse manure. The first two are binders themselves, and decrease the amount of clay necessary while the third is added to open up the sand and counteract the tightening or closing-up effect of the clay.

Portland cement has been used at various times as a binder, and at present at least one foundry uses it for making cores for cast iron pipe fittings. It is used in the ratio of 1 to 10 with some bonded sharp sand in the mixture. Cement is caustic and in a short time will attack the skin of the hands. To overcome that objection, the firm uses core blowing machines which eliminate handling of the sand by the core makers. The cores are air dried.

GRAY IRON

Anneal Not Necessary

We are figuring on an iron plate casting 10¼ inches in diameter, ¾-inch thick with a 5-inch cored hole in the center. Both sides are to be machined and the specification calls for a brinell of 170 to 217 with an added detail of annealing at 1350 degrees Fahr. up to heat. We cannot understand why it is necessary to anneal the casting. The purchaser who is not a designer, states that annealing is not necessary if we can hold to the required brinell. We never have made castings to a brinell specification but cannot see why we should not be able to come within the limits. If the castings are not annealed would we run into any difficulty? Any information you can give will be appreciated.

It is not necessary to anneal the casting described to come within the brinell specifications mentioned. As a matter of fact annealing it any length of time at the temperature suggested will bring the casting way below 170 brinell. The brinell range specified can be obtained by casting in an ordinary green-sand mold using a fairly strong grade of iron. The brinell range can be obtained with a wide range of analyses—merely avoid extremely high silicon-high carbon combinations on the one hand, and low silicon (under 1.0 per cent) on the other to prevent chilled edges. If the customer wants an anneal to avoid subsequent warpage, heat the casting up to 900 degrees Fahr. slowly; hold one hour, and cool slowly in the furnace.

Q & A

Castings Not Hardened

Do malleable cast iron or alloy gray iron castings harden and toughen if tumbled in a barrel for 2 or 3 hours? The castings are quite small such as harness bits and buckles.

Some years ago Outerbridge noticed that gray iron test bars which had been rumbled or tumbled in a barrel gave higher strength values than those not handled in that manner. After investigation he concluded that the tumbling relieved the casting stresses which were present in the bars. Since the bars treated to tumbling do show a higher strength, present specifications for bars state that the bars must not be tumbled. Keep stated that he believed that the high strength obtained by rumbling was due to the fact that the surface skin had been peened by the numerous blows. The blows closed up the surface cracks and generally strengthened the outer fibers of the metal. Of the two opinions given, that of Outerbridge is accepted most generally.

While there is no data on hand on the effect of tumbling on malleable and alloy cast iron, we believe that there is no tendency to harden the castings. If the alloy iron castings are not heat treated, there may be a tendency to toughen them—the term toughen being used in the sense of added strength—similar to that mentioned in the case of the test bar. If you use the term toughen in the sense of hard to machine, our answer is no. There is one thing certain—if tumbling did harden and toughen castings, it hardly would find the favor of cleaning castings that it does as there are few foundries which do not tumble some castings.

Q & A

Can Attain Strength

We have received an order for some castings which states that the iron must have a tensile strength of 35,000 pounds per square inch. Since that tensile is considerably in excess of our regular foundry practice, we would like some information on how we can attain that figure. We have a stock of pig iron on hand which contains 1.20 per cent silicon; 0.035 per cent sulphur; 0.143 per cent sulphur, and 0.71 per cent manganese. Can that iron be used in the mixture, and what other pig iron or scrap should constitute the charge?

Assuming that you refer to the strength of iron in the regular arbitration test bar, it should not be difficult to produce a tensile strength in excess of 35,000 pounds per square inch. However, the chances are that you cannot use much of the 1.20 per cent silicon pig iron unless you are making castings of rather heavy section, say a minimum of 1½ or 2 inches, or unless your customer is willing to take iron that is harder to machine. That is due to the fact that low silicon irons tend to chill in thin sections.

To produce a gray iron with a minimum tensile strength of 35,000 pounds per square inch it will be necessary to maintain an average somewhat above that point, say 38,000 pounds per square inch. Practically all higher strength irons are made with fairly heavy steel scrap additions to the charges. The objective is to reduce the total carbon content as it has a deleterious effect on strength. Some strengthening is obtained by reducing the silicon, and in some cases it also is possible to obtain some strengthening effect from the addition of nickel, and of nickel and chromium. The most effective results are obtained by reducing the total carbon content.

To accomplish that, low carbon pig iron (which usually is high in

silicon) and steel should be added to the charge. Coke between charges should be as low as is consistent with the production of good, hot iron, and the molten metal should be tapped promptly. If it is allowed to remain in the cupola well it will pick up carbon rapidly. It is suggested that not less than 25 per cent steel scrap be used.

The following analyses of metal made in a cupola that melts hot will meet the 35,000 pounds per square inch tensile specifications provided the iron is hot and the bars are poured hot and fed properly: A high steel mix of excellent machinability that will not chill in ½-inch test bars contains 2.90 per cent total carbon and 2.25 per cent silicon. Another high steel mix contains 3.10 per cent total carbon, and 2 per cent silicon. One mixture containing 0.75 per cent nickel has a carbon content of 3.40 per cent, and a silicon content of 1.0 per cent. Another using nickel and chromium has the following analysis: Total carbon, 3.40 per cent; silicon, 1.20 per cent; nickel, 0.75 per cent, and chromium, 0.15 to 0.20 per cent.

It must not be forgotten that the analysis is not the only factor in producing of high strength gray iron. The relationship between the section and surface area of the test bar and those of the casting must be considered carefully.

Q & A

Bars Are Standardized

What are the dimensions, and other data on the standard bars for determining the tensile and transverse strengths of cast iron?

The standard bar used for determining the physical properties of gray iron is called the arbitration test bar and conforms to the dimensions, method of making, and handling as described in American Society for Testing Materials specification A 124-29, which also has been adopted by the American Foundrymen's association. The bar without the sprue is 21 inches long, rounded on the lower end, and the pattern is designed so that the bar is 1.20 inches in diameter at the center. The bar is poured vertically in a cold, dry-sand mold or in a core. A pouring basin is used and the sprue is 2 inches long tapering from ¾ to ⅝-inch, the larger diameter being attached to the bar. The bar is not rumbled or otherwise treated before testing, being simply brushed off.

The transverse test is performed by placing the bars horizontally on supports 18 inches apart and applying the load in the center. The tensile bar is prepared from one of the broken sections from the transverse test bar. The length of the tensile specimen is 3½ inches, and 1⅛-inches in diameter. One inch is allowed on each end for a standard thread to fit the holders of the tensile machine. The remaining central section 1½ inches long is turned to 15/16-inch in diameter. Shoulders ¼-inch wide with that diameter are left adjoining the ends for threading, and the remaining 1-inch portion in the center is turned to 0.80 inches in diameter with a fillet of ⅞-inch radius from the shoulder to the

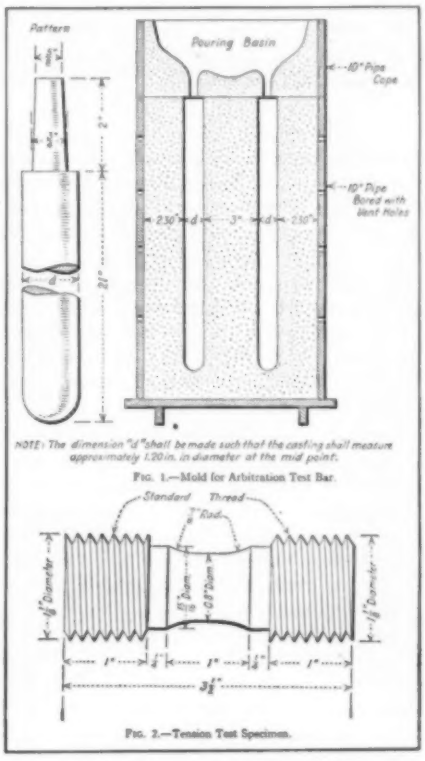


FIG. 1.—Mold for Arbitration Test Bar.

FIG. 2.—Tension Test Specimen.

Arbitration Test Bar Data

0.80-inch center as shown in the accompanying illustration.

Q & A

Carbon Will Not Score

Somewhere I have read that when gray iron is heat treated, the carbon separated as temper carbon which produced a product that would have a tendency to wear or score other iron and steel parts into which it came in contact. We are contemplating the heat treatment of piston rings for a high speed cylinder, and of course, such condition would be detrimental. Have you any information on the subject and any data on the heat treatment of piston rings of ⅛-inch section containing about 3.75 per cent total carbon?

While some investigators have stated that heat treatment of gray iron appears to spheroidize the graphite to some degree, we hardly believe that it could be called temper carbon such as occurs in annealing hard iron for malleable casting. Even if the carbon in heat treated gray iron was precipitated as temper carbon, we can see no reason why it should wear or score any more than graphite as the difference is one of degree, that is to say graphite is crystalline carbon while temper carbon is amorphous. Therefore, we would not worry much about the propensity of carbon to wear or score. If you were to heat treat and quench the castings so that the structure would become harder, then wear or scoring might occur, but that would be due to the fact that the carbon is combined with the iron and manganese, to form hard carbides.

Hurst mentions heat treatment of piston rings at 1020 to 1110 degrees Fahr. for a short time to eliminate permanent set. Pistons with a total carbon ranging from 3.25 to 3.50 and a silicon content from 1.88 to 3.25 per cent were heat treated at 1400 to 1450 degrees Fahr. for 1 to 1½ hours to increase machinability and soften them. Since your rings have a small cross section, the temperature should not be too high nor the exposure at the temperature too long. It also may be worthwhile to cover the rings with coke dust to prevent the formation of scale. Try the temperature ranges mentioned under varying lengths of time, until you obtain the desired results. The castings should be heated and cooled slowly.

MALLEABLE

Chrome Is Negligible

Is rolling mill scale superior to coarse sand or gravel as a packing material for malleable annealing? What do you think would cause excessive reduction in carbon content as indicated by analysis of castings in which the white iron had 2.84 per cent total carbon, but after annealing had only 0.185 per cent total carbon? Do you consider 0.076 per cent chromium in steel rails a dangerous amount for charging in malleable heats? About 2000 pounds of such steel rails are used in a 17-ton heat. The remainder consists of about 47 per cent pig iron, and the remainder sprue and malleable scrap.

If decarburization is desired, rolling mill scale would be superior to the gravel, but most malleable manufacturers prefer not to have decarburization occur. Long time, high temperature, and oxidizing packing make for decarburization, and any or all of those factors may account for the reduction in carbon content that you mention. According to the data you give, you use about 6 per cent steel in your charges, which at 0.076 per cent chromium should increase the chromium in the charge by 0.0045 per cent. Indefinite repetition of the process might raise the chromium by 0.01 per cent which of itself should be of no importance. Thre is considerable difference of opinion regarding the importance of chromium in malleable cast iron. Some hold that even 0.01 per cent is harmful while others state that 0.07 per cent does no harm. Most malleable pig contains a litte chrromium. It is suggested that you analyze your finished product to determine exactly how much chromium is contained.

Problems in Nonferrous Founding

By Charles Vickers

Copper Tuyeres Crack

We have experienced considerable trouble in casting our copper tuyeres, coolers and cooling blocks, used in blast furnace operation. At one time we used a certain amount of tin in the mixture, but our furnaceman now insists on pure copper. At times we have poured a mold and in a few minutes the metal came up in the riser or after the mold was full the metal would back out. At other times the castings would have small cracks on the side and therefore fail under hydrostatic pressure. Sometimes the castings show a draw around the gate which is porous and honeycombed. While testing these castings, the water sometimes seeps through, and by striking these leaky places with a hammer, we find a thin shell which we presume is a gas pocket. However, this condition sometimes exists and the casting looks sound and does not leak. We use a rotary melting furnace, 2000 pounds capacity and melt with a mixture of by-product gas and furnace blowing engine air, the flame of which comes into direct contact with the metal except for a charcoal covering. Our charges are 800 pounds, and consist of 80 per cent copper wire and 20 per cent return scrap. About 2½ pounds of 15 per cent phosphor-copper is added to each charge of metal entering the furnace, and 2½ pounds is added to the ladles. After a charge is melted and just before pouring, we take an oak pole and thoroughly stir. We do not have a pyrometer and therefore, cannot give you the pouring temperature. Can you tell us from the above facts, what causes the gas pockets, cracks, and the cause of other troubles we are having. How much phosphor copper should we use to a charge of 800 pounds? Also do you consider it necessary to stir the metal with a hardwood pole?

We make the suggestion that you return to the use of tin, as this metal is commonly used in tuyeres to improve fluidity and aid in preventing the troubles that you are having. It is not necessary to use enough tin to make bronze, but 5 per cent will be a great improvement. The furnaceman, no doubt thinks that the tin lowers the fusing point of the copper, and therefore the tuyeres melt more easily, but a moment's reflection will convince him that the addition of the small amount of tin that is used in tuyeres, will have little effect on the melting point of the copper, and is hardly worth considering. Often an alloy composed of 97 per cent copper and 3 per cent tin is used for making tuyeres, cooling plates, and other blast furnace castings.

If the copper swells out of the pouring heads and risers, it will be necessary to increase the amount of phosphor-copper. There is a considerable variation in regard to the amount of phosphorus used in making tuyeres. Some makers add half a pound to the hundred pounds of copper. Others find this insufficient, and use three-fourths of a pound per hundred. Still others have to use 2 per cent. It all depends on how the copper is melted. If it is melted under a cover of charcoal as in this case, it will probably be found necessary to add 8 pounds of phosphorus-copper instead of 5 pounds, which is 1 per cent. Since wire is being used to the extent of 80 per cent of the charge, it may be necessary to use 1 per cent of phosphor copper, and 1 per cent of phosphor tin. Sometimes it is advisable to include a proportion of wire scrap, even when using all ingot copper, due to the fact the ingot copper happens to be over-poled, and the additional oxygen brought in by the wire tends to counteract the effect of the overpoling of copper.

However, it is just as bad to go the other way. Copper forms an alloy with cuprous oxide and the combination is not strong, so easily cracks. Anything that makes the copper hot short will favor cracking and anything that increases the shrinkage will do the same thing. Producer gas high in sulphur is bad if it impinges on the metal. Under a blast, charcoal is not of much value, so we suggest the use of some good brass flux, such as advertised in THE FOUNDRY, or powdered glass. Be sure and use something that will take the punishment instead of the metal otherwise, the cracked and blown tuyeres will continue right along. Also do not make the slag cover too thick as that will slow down your melting rate. Poling the bath is not necessary.

Chill Phosphor Bronze

We contemplate making chilled nickel, phosphor bronze gears and worm wheel rims. This is the first time we have required that alloy and we would appreciate information on the chills used, composition of alloy, order of melting, and pouring temperature. We melt in natural draft, coke-fired, crucible furnaces.

Chills usually are made of cast iron of heavy section, but graphitic carbon can also be used. There are several ways of chilling the blanks. They may be chilled on the drag side, with a green sand cope, and a dry sand core for the inside to form the ring. The copes are made on a molding machine, the drag is the chill, which is heated up in the morning after being well rubbed up with plumbago. Just before the metal is ready, the molds are heated and the ring cores are set in place. The mold is cleaned with air blast, the cope closed and weighted and poured. In a few minutes it can be shaken out cleaned, cored and prepared for a second casting.

That method produces a good gear blank. A green sand cope ensures the blank will be well fed to obviate shrinkages, as the risers being in sand will remain liquid long after the casting has set. However, should you feel that chilling the cope is also necessary; instead of using molding sand, use a plastic chilling compound, made of carborundum fire sand mixed with a suitable binder. The all-chilled gear blank is made in a mold split into two halves and pinned like a core box; the blank is cast vertically, and a core is used for the interior. The core is made of chilling compound. This gives a completely chilled gear, but it is difficult to avoid shrinkage defects, even when the riser is formed in a dry sand core. Some manufacturers prefer a casting of more open structure; one that will absorb a certain amount of oil as it will then run cooler and with less friction. A suitable nickel bronze is: 85 pounds of copper; 10 pounds of tin; 3 pounds of 15 per cent phosphor-copper and 2 pounds of nickel. Add the nickel as 50-50 copper-nickel with the cold copper. In a coke furnace use charcoal on top of the copper. Pour at around 1900 degrees Fahr.

The FOUNDRY Family Photograph Album

Upper Left

G. W. MERREFIELD

Pettibone - Mulliken Co., Chicago

Upper Right

ALFRED HALEY

Warren Foundry & Pipe Co., Phillipsburg, N. J.

Lower Left

R. F. JOHNSON

Newton Die Casting Corp., New Haven, Conn.

Lower Right

S. L. DRYFOOS

Universal Sand Equipment Co., Cleveland

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TENTATIVE SPECIFICATIONS FOR

Aluminum—Base Alloy Castings

(Concluded from Data Sheet No. 862)

Alloy H has a specific gracity of 2.80. It is usually used in the heat-treated condition. It has advantage over the copper alloys of retaining more of its strength at elevated temperatures. This property makes the alloy useful for aircraft cylinder heads and pistons.

Alloy I is somewhat lighter than aluminum, having a specific gravity of 2.69. It withstands corrosion better than the copper alloys. The free flowing property of the alloy when molten makes it easier to pour castings of thin sections or intricate design. It has a lower strength and yield point than the copper alloys and poorer machining qualities. It is especially suitable for automobile body parts, cooking utensils, and marine castings.

Alloy J has a specific gravity of 2.68. Immediately before pouring, the alloy is treated by a process called *modification*. Its corrosion resistance is good, especially to salt water. It has good foundry characteristics and can be used for castings having both thin and heavy sections. It is not as readily machined and has a lower yield point in proportion to tensile strength than most of the copper alloys. It is used for architectural and marine castings, bus, street car, and engine parts, and for thin castings such as radiators, small motor housings and meter cases.

Alloy K has good casting characteristics and a higher yield point than the silicon alloys without copper. It is used more extensively for match plate and pattern work.

Note 2

Some latitude has been allowed in the matter of test specimens; test bars *cast-to-size* are stronger than those which are *machined-to-size* and the tensile properties specified are regularly obtained in commercial production only with the *cast-to-size* bar. When *machined-to-size* specimens are required to meet the values given in these specifications, rejections may be expected to run higher than those experienced in usual commercial production. Owing to insufficient information being available on the tensile properties of *machined-to-size* specimens it was not possible to include a separate table of values for this type of specimen.

Note 3

It is strongly recommended that a self-centering form of tension test specimen holder be used. Most aluminum alloys are brittle and give lower and less uniform test results when tested in ordinary wedge grips without centering.

MENSURATION DATA FOR CIRCLES

AREAS OF CIRCLES AND LENGTHS OF THE SIDES OF SQUARES OF THE SAME AREA

Diam. of Circle in Inches	Area of Circle in Square Inches	Sides of Square of Same Area in Square Inches	Diam. of Circle in Inches	Area of Circle in Square Inches	Sides of Square of Same Area in Square Inches	Diam. of Circle in Inches	Area of Circle in Square Inches	Sides of Square of Same Area in Square Inches
1	0.785	0.89	21	346.36	18.61	41	1320.26	36.34
1 1/2	1.767	1.33	21 1/2	363.05	19.05	41 1/2	1352.66	36.78
2	3.142	1.77	22	380.13	19.50	42	1385.45	37.22
2 1/2	4.909	2.22	22 1/2	397.61	19.94	42 1/2	1418.63	37.66
3	7.069	2.66	23	415.48	20.38	43	1452.20	38.11
3 1/2	9.621	3.10	23 1/2	433.74	20.83	43 1/2	1486.17	38.55
4	12.566	3.54	24	452.39	21.27	44	1520.53	38.99
4 1/2	15.904	3.99	24 1/2	471.44	21.71	44 1/2	1555.29	39.44
5	19.635	4.43	25	490.88	22.16	45	1590.43	39.88
5 1/2	23.758	4.87	25 1/2	510.71	22.60	45 1/2	1625.97	40.32
6	28.274	5.32	26	530.93	23.04	46	1661.91	40.77
6 1/2	33.183	5.76	26 1/2	551.55	23.49	46 1/2	1698.23	41.21
7	38.485	6.20	27	572.56	23.93	47	1734.95	41.65
7 1/2	44.179	6.65	27 1/2	593.96	24.37	47 1/2	1772.06	42.10
8	50.266	7.09	28	615.75	24.81	48	1809.56	42.58
8 1/2	56.745	7.53	28 1/2	637.94	25.26	48 1/2	1847.46	42.98
9	63.617	7.98	29	660.52	25.70	49	1885.75	43.43
9 1/2	70.882	8.42	29 1/2	683.49	26.14	49 1/2	1924.43	43.87
10	78.540	8.86	30	706.86	26.59	50	1963.50	44.31
10 1/2	86.590	9.30	30 1/2	730.62	27.03	50 1/2	2002.97	44.75
11	95.03	9.75	31	754.77	27.47	51	2042.83	45.20
11 1/2	103.87	10.19	31 1/2	779.31	27.92	51 1/2	2083.08	45.64
12	113.10	10.63	32	804.25	28.36	52	2123.72	46.08
12 1/2	122.72	11.08	32 1/2	829.58	28.80	52 1/2	2164.76	46.53
13	132.73	11.52	33	855.30	29.25	53	2206.19	46.97
13 1/2	143.14	11.96	33 1/2	881.41	29.69	53 1/2	2248.01	47.41
14	153.94	12.41	34	907.92	30.13	54	2290.23	47.86
14 1/2	165.13	12.85	34 1/2	934.82	30.57	54 1/2	2332.83	48.30
15	176.72	13.29	35	962.11	31.02	55	2375.83	48.74
15 1/2	188.69	13.74	35 1/2	989.80	31.46	55 1/2	2419.23	49.19
16	201.06	14.18	36	1017.88	31.90	56	2463.01	49.63
16 1/2	213.83	14.62	36 1/2	1046.35	32.35	56 1/2	2507.19	50.07
17	226.98	15.07	37	1075.21	32.79	57	2551.76	50.51
17 1/2	240.53	15.51	37 1/2	1104.47	33.23	57 1/2	2596.73	50.96
18	254.47	15.95	38	1134.12	33.68	58	2642.09	51.40
18 1/2	268.80	16.40	38 1/2	1164.16	34.12	58 1/2	2687.84	51.84
19	283.53	16.84	39	1194.59	34.56	59	2733.98	52.29
19 1/2	298.65	17.28	39 1/2	1225.42	35.01	59 1/2	2780.51	52.73
20	314.16	17.72	40	1256.64	35.45	60	2827.44	53.17
20 1/2	330.06	18.17	40 1/2	1288.25	35.89	60 1/2	2874.76	53.62

THE FOUNDRY DATA SHEET, JUNE 1, 1931

Payment will be made for all contributions on foundry and pattern shop practice suitable for publication

BILL

By Pat Dwyer

Hears Plea for Better Prices

I HAVE been reading THE FOUNDRY," Bill remarked the other night, "off and on for nearly 40 years. Kindly correct me if I am wrong, but it seems to me that the paper first was issued in 1892. I started to serve my time in 1891 and I know I had not progressed far along the thorny path when my greedy eyes fell on the first copy lying on the old man's desk. I sneaked in while he was out to lunch at noon and became so interested that he came back and caught me red handed in his sacred den. I was young and innocent in those days and fully expected to be fired on the spot. The old man was a rampaging, profane and sarcastic autocrat at times, with a temper made up of equal parts of gun powder, oil of vitroil and ancient liederkranz cheese. When I looked up and found his piercing eye on me I realized to the full how a little shrinking rabbit feels before a hungry wild cat falls upon him with teeth and claws.

To my surprise, and ecstatic relief he smiled in the most friendly manner and told me to take the book home if I wanted to read it. Afterward from month to month he gave it to me voluntarily.

"Despite his dictatorial ways and occasional tempermental flareups, I came to have a genuine liking for the old lad and parted from him with regret when my apprenticeship expired. He was a first-class foundryman and gave me every opportunity to learn the trade properly Eight or 10 years ago I saw him at a foundryman's meeting and I had very great pleasure indeed in paying public tribute to my old friend."

"All quite interesting," I admitted, "but if you will pardon me for reminding you, I should like to know what prompted you to talk about THE FOUNDRY. I suppose you had something definite in mind. If you have not forgotten what it was—"

"No," Bill said, "I have not forgotten. What I started to say was that I have been a fairly steady reader of THE FOUNDRY ever since it first came out and have watched its progress with a great deal of interest from its modest beginning to its present high plane of excellence. I have read special editions, convention issues and anniversary numbers and I am here to tell you, my lad, that the April 15 number, the pre-convention issue this year, was the finest job in all its long history.

Appearance Are Deceitful, but Certainly They Do Look Crooked—Both of Them

"That comprehensive tribute to the extent, value and importance of the foundry industry by the heads of great corporations and prominent men engaged in every form of industrial activity, should go a long way in stiffening up the morale of all those engaged in the casting of metals. It should help them to realize that the foundry is a great basic industry, essential to the functioning of practically every other industry. It was in existence before men even had dreams of the others. It has been nurse and hand maid to most of them and in all probability will show as great a measure of improvement growth and expansion in the coming hundred years, as it has in the century just passed. But—"

"Ah," I said. "So there is a but in it. I thought you were slipping along too smoothly. Would you mind throwing that prophetic eye of yours into the future and tell me if you can see any indication of rising prices for castings?

"The nurse or hand maiden is engaged in a noble profession and deserves all your eulogistic reference. Unfortunately eulogistic references, however glowing, are not negotiable and are not accepted as collateral by the frosty-eyed banking fraternity when a foundryman needs funds to meet running expenses. Instead of a nurse, a foundryman needs a miracle worker if he expects to survive a suicidal attempt to sell castings below the cost of production."

"Well," said Bill, "I'll tell you. I had a letter from a lad along that line the other day. He has a delightfully free and easy style and introduces some apparently irrelevant material, but his conclusion is fundamentally sound and is worthy of serious consideration. He started off by directing my attention to the almost universal pernicious custom of trying to beat down prices. Then he wandered off into some reminiscenses and finally came back to the point at issue. Since the conclusion is a reiteration of the beginning, I shall omit the first part and commence at the paragraph where he writes:

Quite a difference since the old days when George Bowers was on the line-up for making Ford cylinder blocks as they should be made. That was before they faced 'em, bored 'em out, drilled and tapped 'em and run the finished car off the line before the cylinder castings had a chance to even cool off properly.

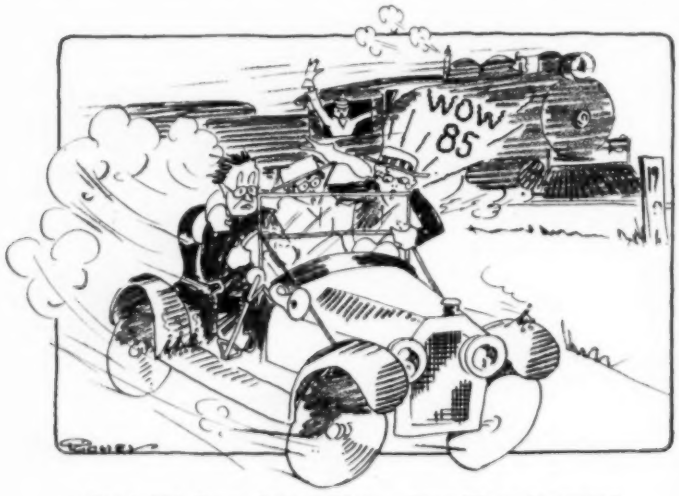
In those days I was one of the straw bosses out at Stearn's where we made three cars a week, and made 'em right.

The cylinder blocks were put out in the yard to season for six months. Then they were taken in and rough bored. They were given another three weeks' rest to allow the molecules and atoms and one thing and another time to adjust themselves after the operation, and then they were reamed. After the reaming they were given a week in which to prepare for the final operation, fitting the pistons. The pistons were lapped into the cylinders with a mild dose of rouge and allowed to run four hours on a specially rigged up revolving table on a drill press.

After each car was finished it was taken for a trial spin of about 400 miles, to Buffalo and back again. This was supposed to limber it up and there was no specifications about holding her down to 25 miles per hour. Every driver tried to break the record of his predecessor and usually hit anywhere from 60 to 80 miles an hour—Oh, boy—over them dirt roads.

Mrs. Vanspeed was one of the early

speed enthusiasts. She owned a single seater and had established a new speed record between Cleveland and Toledo. She hankered after new worlds to conquer. Word had come to her ears about the way some of these birds stepped between Buffalo and Cleveland and she says to herself says she, "We'll see. I have the record to the West and I'll just show 'em that I am no one way piker.



Good Old Days Before Motor Cops Were Invented

East or West is all the same to me. I'll fly east," says she, "or I'll fly west and if anybody says it can't be done," says she, "I'll fly over the cuckoo's nest!"

She came out to the shop one day and told Frank Stearns she wanted to borrow Jim Patton to help her grab off the Cleveland-Buffalo road record. Jim was assistant superintendent at that time and had done some racing with Barney Oldfield. Frank took the lady out into the shop where Jim had just finished an aggravating job and was dirty and grimy and cranky as hell to boot.

"There he is," says Frank, "at the present moment he is as touchy as a wild cat and I don't want to go near him. Go over and make your own medicine talk—an' I'm sure I wish you luck!"

At first Jim refused to consider the proposition, but the lady pleaded so prettily that after a while he kind of wilted and asked her when she figured on trying for this record.

"Tomorrow morning," she said. "At 3.30 a.m., if it does not rain."

"All right," says Jim, "You check out officially at the Hollenden and then when you pass here in front of the shop you can slow down a little and pick me up. I'll be standing by the curb in front of the office door. Maybe I'll ride out with you as far as Willoughby just to see that the old boat is running O.K., and according to specifications."

He would commit himself no farther so she let it go at that and retired to make the necessary preparations.

In the morning, accompanied by her sister, she came scorching out along Euclid avenue and picked Jim up according to schedule. He sat in the middle of the wide seat and never said a word until they were crossing the railroad bridge at Collinwood. On account of Mrs. Vanspeed being a customer and a lady, he had to kinda tone down his remarks so he simply says: "What do you think you're drivin', a hearse at a funeral? I'm a busy man with a pile of work waiting for me at the shop and I got no time to play around with you and your amateur drivin'. When I consented to come with you I thought I was goin' to see some drivin'. Bah! Twice! Lemme out. Out for a record, hey? Har, har." Here is where the sister played her trump card. She looked past Jim to Mrs. Vanspeed "Perhaps," she drawled. "Perhaps he really thinks he can drive this car." The tone and the implication just fairly burned Jim up. "Here," he said, "change places with me and I'll show you how to drive a car that was made to be driven a trifle—just a trifle—faster than a peddler's hand cart."

They shifted places while hopping along at about 65. Jim settled himself down in the driver's seat and mentally vowed that if the old wagon held together he'd give some people a mark to shoot at that would hold them for a while. The people clung to the sides of the car, to each other and to Jim. A delighted squeal from the sister every few miles indicated that all doubt had been set at rest and that she now recognized that a master driver was on the job. Mind you, all this was nearly 27 years ago when the roads were either dirt or macadam, no traffic cops, very few automobiles, hardly any traffic of any kind early in the morning, the start had been made at 3:30 a.m. and Jim had taken command about 4:00. The road was full of ruts, sharp curves, stones and mud holes, but Jim had driven over it so often in test runs that he could do it on a pitch dark night, and the head lights then were not what they are now.

They went through Ashtabula like the devil went through Athlone in three mighty hops. For years afterward pop eyed milkmen in Erie told of the roaring streak that flashed through the town like the tail of a comet on a certain morning and sent their staid steeds to climbing telegraph poles. Early risers in sleepy old Dunkirk heard the approaching demon, blinked their eyes once and then saw the same demon disappearing in a cloud of dust on the far horizon.

Outside Buffalo where the road parallels the railroad track they overhauled and passed the Lake Shore & Michigan Southern fast mail. The engineer joyously reached for the whistle cord and paid his tribute to the god of speed in one long piercing blast.

"Go it! You devil," he shouted and leaned on the cord again, one, two, three, four long imperious screams for an open semaphore.

At Main and Exchange Streets, Jim slowed down to 20 miles per hour and hopped out. Mrs. Vanspeed tooled the machine up to the old Iroquois hotel and checked in 3 hours and 20 minutes from the Hollenden in Cleveland, approximately 200 miles.

The papers played the story up in great shape with the single exception that no mention was made of Jim. He modestly effaced himself and maintained a discreet silence, both then and thereafter. Always a gallant lad, Jim.

About a week afterward the lady came out to the plant office and told Frank Stearns she wanted to see Jim.

"Go out in the shop and hunt him up," says Frank. "Its like pulling teeth to get that bird to come in here."

Out she prances like the lady she was. She walks right up to Jim and plants a kiss right on his grimy puss. Before Jim can recover himself she presses a little package in his hand and beats it.

Jim makes a few appropriate remarks which fortunately the lady did not hear. Then he opens the package and nearly drops dead when his eyes

Clear Away the Lifeboats—Hard Words Coming

light on a $600 Jurgenson watch suitably engraved with his name and the date and a reference to the famous event.

Any time you see Jim ask him for the time o' day and you will see the watch. Well, to make a long story longer my wife now is driving her third Stearns and the gage shows

that it has run over 43,000 miles. Last Sunday she was knocking off 85 miles an hour on a nice stretch of road where it was possible to see a few miles in advance. The engine was running as sweetly as a babe sleeping in the crib and the car was as steady as a Pullman in the middle of the Century on that long straight stretch outside Toledo.

Here, here, here. I started to write you a letter about the prices of castings and look where we rambled off to. Don't it beat hell how the women divert our minds?

"Does the letter end there?" I asked Bill.

"Not at all," Bill said. "Not at all. That is just the end of part 1. In part 2 the writer gets down to brass tacks and shows first what is wrong with the business situation, and second, his proposed remedy. Personally, I think he has the right idea and you will see in the next few months that he is right. One for all and all for one is just as appropriate for a slogan now as it was in the good old days when D'Artagnan and his musketeers ruffled their feathers and baited Richelieu's gamecocks."

"Before going any farther," I interrupted. "Tell me one thing. Is this writer by any chance the secret agent of a certain foreign government. This one for all and all for one sounds suspiciously like the insidious propaganda at which sundry citizens point with alarm."

"You can set the old mind at rest," Bill said. "This lad who wrote me the letter can trace his ancestry back to pre-revolutionary days and on occasion has been known to join in three rousing cheers on the fourth of July—and other festive occasions.

He has been around quite a bit in his time and has a long list of personal anecdotes about people and events that only are known to the present generation by way of hearsay. Every once in a while he comes across with one.

No, sir. He is a manufacturer of foundry equipment and he is a grand little believer in the doctrine that the laborer is worthy of his hire. He does not believe in giving his stuff away and he is willing to pay a fair price for his supplies. Here's the second part of the letter:

Several years ago I went to see a certain big shot in the automobile business. He and his 64 purchasing agents had a settled policy of beating all manufacturers of equipment down to the last and ultimate piaster. At a general meeting of the big shot, the general purchasing agent, his three principal assistants, the auditor and the foundry superintendent and a general sprinkling of lesser lights, I told them a few things for the good of their immortal souls. In my enthusiasm I may have added a word or two designed more for emphasis than for elegance.

Smoothly running sentences and nicely rounded periods are all right in their place and will serve when a fellow is talking just for the pleasure of hearing himself talk, but when a man is in deadly earnest and wants to put something across, he usually feels the necessity of drawing on the reserves, the solid, bouncing, robust words that for a thousand years have braved the battle and the breeze. On this occasion I had nailed the old colors to the main top and if I had to go down, I meant to leave them something to remember me by. Fair enough, sez you and you can lay to that.

I tried to show this bunch of highbinders that good, honest workmen were entitled to a living wage and that a manufacturer was entitled to a fair profit. If you interfere with this foundation, the whole superstructure ultimately will collapse like a house of cards when one card is pulled away.

From the beginning, digging the iron ore, you can follow the process all the way through the transportation stage, the blast furnace, the pig machine, the foundry, the machine shop and ultimate shipping of the finished product. The prosperity of every man connected with any stage of the process is linked with the prosperity of all those engaged in the other stages.

Any person who attempts to pinch the stream at any point is building up trouble for all others along the line. He is starting the entering point of a wedge for a first class stretch of hard times that usually ends up in a panic, in which he is involved with the others.

I don't know if it was my talk or the recent squeeze we have been passing through, but I notice that recently this automobile big shot is getting away from some of his former ideas and seems to be willing to let some other manufacturers make a decent living.

In my own business, you know I use a considerable number of castings. I don't go shopping around for bargains or attempt to get castings for next to nothing. I go to a reliable foundry man, one with a reputation for turning out good, honest castings and tell him how I want my castings made and what kind of stuff to put in 'em. If he is willing to give me what I want I don't haggle over his price. He can't run his foundry on hot air and broken promises any more than I can run my business on the same kind of income.

Boiled down to go in a nutshell —and not a cocoanut either—the whole business situation resolves itself into the necessity to play square. If one company makes 1,000,000 cars a year and 1000 manufacturers make the parts at a loss, does that mean prosperity?

I have my doubts, the same as the colored widow at the funeral. The preacher dwelt at great length on the good traits of the deceased brother; what a good, honest man he was, what a good provider for his family; what a loving husband and father. The widow became increasingly restless. "Johnnie," she whispered to one of her numerous sons, "go up day an' look in dat coffin and see if dat's yo' paw!"

German Founders Meet

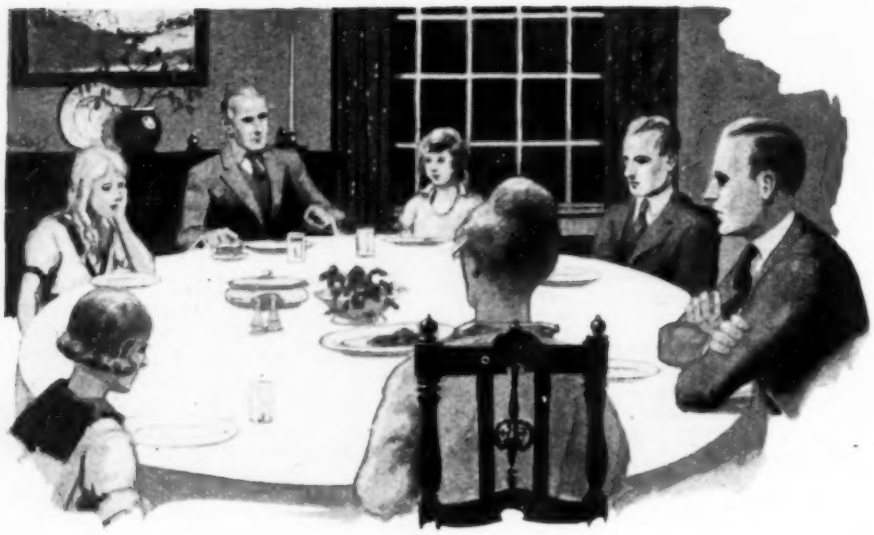
The twenty-first annual meeting of the Vereins Deutscher Giessereifachleute was held in Berlin on May 16. In the morning the opening of the apprentice exhibit of pattern construction took place in the quarters of the Vereins Deutscher Ingenieure. In the afternoon a technical session was held and five papers were presented. These included "Slag Formation in the Cupola with Special Consideraton of the Application of Fluorspar," by Prof. Uhlitzsch, Freiberg; "Principles of Alloying Cast Iron with Various Metals," by Dr. F. Roll, Leipzig; "Bending Strength, Deflection and Graphite Separation," by Dr. Brinckmann, Sprostau, and "Work and Economy," by Prof. D. K. Dunkmann, Berlin.

In connection with the meeting of the Vereins Deutscher Giessereifachleute, the Technical Hochschule of Berlin held a short course on metal foundry technique in co-operation with the Giessereifachleute, the Deutschen Gesellschaft fuer Metallkunde, and the Gesamtverband Deutscher Metallgiessereien at the Berlin school on May 18, and at the Technical Hochschule of Charlottenburg on May 19. Papers which were presented at the two sessions included the following:

"Tombasil, a New Silicon-zinc-copper Alloy," by Dr. E. Vaders, Finow (Mark); "Zinc-bronzes, Special-bronzes, and Red Brass Alloys as Chemically Demanded Materials in General Machine Construction," by Dr. W. Claus, Berlin; "Water-cooled Chills for Rolls and Ingot Molds," by Dr. K. Scherzer, Lammersdorf; "Binary Lead Bronzes and Ternary Lead-tin Bronzes," by Dr. W. Claus, Berlin; "Sandblasting," by Prof. U. Lohse, Hamburg; "The Advantages of Steel Grit in Sandblasting," by Dr. G. H. Zirker, Berlin; "Casting Cleaning Hydraulically," by Dr. A. Rodehueser, Durlach; "Silica-sand Cores (Oil-sand Cores) with Special Consideration of the Metal Foundries," by Oberingenieur H. Kupper, Hannover, and "Snapflask Molding," by Oberingenieur H. Hartmann, Hannover.

Acquires Hoist Company

McKiernan-Terry Corp., New York, has acquired the manufacturing business of the Lambert Hoisting Engine Co., Newark, N. J., including machinery, designs, patterns, fixtures, inventory and materials. The Lambert line of hoists will be continued at the Harrison, N. J., plant of the McKiernan-Terry Corp. under the name of the Lambert Hoisting Engine division of the new owners. John A. Lambert will be in charge of manufacturing and sales activities has been transferred to the general sales office of McKiernan-Terry Corp.



"On the same evening, an important family conference took place"

YOUNG MEN

—How To Keep Them Away

By
C. J. Freund

THE monthly meeting of the foundrymen's club was in full blast. Fifty or sixty men had been served and only tumblers of water and ash trays remained on the long table. As the evening progressed, the meeting became more and more informal; chairs which had stood sedately upright were now tilted precariously backward, waistcoat buttons were opened and many a pipe was filled with plebeian tobacco as the cigars were consumed. The room was so full of smoke that the ceiling was barely visible.

Apprenticeship Is Discussed

The speaker of the evening had devoted an hour and a quarter to modern annealing methods. A lively discussion followed for another half hour whereupon the conversation drifted to this and that. The labor situation had come in for its share of attention and at the moment all present were talking of apprentice training except two gentlemen at the far end of the table who were earnestly engaged in working out the reason for the defeat of their college at football on the previous Saturday afternoon.

The subject of apprentice training frequently came up in these meetings of the foundrymen's club, largely because of the publicity given the movement in recent years. As a matter of fact, they had done almost nothing in the field of apprentice training, although their industry was easily the most important in the community.

The production manager of one of the larger foundries was speaking.

"We have often thought that we would like to train young men for our business but we can't get young men to work in the foundry, they are too good for the business. They all want to be bond salesmen or assistants to the president. Sometimes I stop the young fellows who come to the house to see my boy and tell them they ought to get into the foundry business and make it their profession or occupation, but they just look at each other and then break out laughing; they think I'm kidding them."

He had voiced a favorite prejudice and his remarks were greeted by a general shifting of bodies on squeeking chairs and a murmur of agreement and approval.

The superintendent of a steel foundry spoke up.

"That's right. I know all about it because we tried it two years ago. We had read and heard so much about this apprenticeship business and we couldn't get molders anyway so we thought we'd try it. We got three boys and put them to work in the plant. We told the foremen to teach them how to mold and make cores. Well, in less than 2 weeks two of them quit. The other one hung on, he was a persistent cuss, but after 6 months he said he had to help his father take care of his grocery store but I always thought he would have quit anyway."

"What the foundry business needs," continued a branch plant manager, "is to get in some of the higher caliber young men, leaders in high school and college, the type of young fellows who go to the big industries and public service companies. They are hired during the school year before they graduate. The foundries never try to hire seniors; it would be a waste of time. I wouldn't sign up for the foundry myself if I were a senior in college."

The next contribution came from the accepted humorist of the group in a voice of forced irony. "Can you imagine class leaders in the schools, football captains and such, making a rush for the foundry when they graduate?" There was a roar of sardonic laughter as the foundrymen felt sorry for themselves.

Goes Into Conference

"Seriously though, there is no use fooling around with industrial training and all that as long as young men don't want to get into the foundry business," remarked the president of a machinery building corporation. "They don't want to work in the foundry or anywhere else where physical exertion is required and we can't make over the whole young generation."

And so the conversation ended—as it always did—and the group took up a favorite topic, of much greater interest than young foundrymen—foundry sand.

These foundrymen fully realized the need for high grade young men in their plants but strange to say, although otherwise intelligent, they had never reached the obvious conclusion that desirable young men would not come spontaneously but that something had to be done to attract them.

On the same evening an important family conference took place in a neat cottage on one of the elm shaded, residential streets of the city. This conference had to do with the selection of

an occupation for the older son of the family of William Parker, a bank clerk. Parker had been no great financial success but he and his wife had maintained a charming home in which a certain culture and a respect for the old decencies prevailed. As a result of the atmosphere in the home, the five children stood out among their fellows not only for ability but for personality as well.

The older boy, Leslie, or Les, was exactly the type of boy the foundrymen said they could not find. He was not too brilliant but a good thinker and had a lot of common sense. He had played a leading part in the activities at school without becoming conceited over his success or even self conscious about it. He had good manners, a good humored disposition and there seemed to be no limit to his enthusiasm, his energy or his perseverence.

Making the Decision

During his later years at school he had devoted considerable time and attention to the choice of a suitable vocation or occupation. He had often talked the matter over with teachers and the vocational guidance director at the school and as a result he understood his own character, with its strong and weak points, and had formed a fairly correct estimate of the opportunities which the city offered to young men. Time and time again he had discussed the problem with his parents and he and they had become impressed with the advantage of apprenticeship as the ideal preparation for an occupation when technical or professional training is not available.

Les had been graduated from high school in June and the family finances did not permit a college education. Since graduation he had been employed by a paving contractor for whom he had worked the two previous summer vacations. Heavy frosts had ended the paving work and he was now faced by the necessity of starting out in dead earnest on his life work.

Just like the foundrymen, the Parker family held their conference over the dinner table. Les and his parents took the principal part. His brother George, younger by 2 years, expressed his opinions now and then and was irritated because they were not taken seriously. The younger children, all girls, were much awed by the momentous occasion and except for occasional questions, remained spectators only.

Les had often said that the foundry business should offer the greatest opportunity in the city since it was by far the most important. Again he repeated his opinion. He had enjoyed what little foundry work he had done in high school and was disposed to go into the casting industry. However his mother had not been able to reconcile herself to the choice.

"I have no doubt," she said, "that the foundry industry is the most important in the city and offers many opportunities but it isn't what I should call desirable work, it is so dirty for one thing and I have never felt that foundrymen were our best people; and we want you to be always respectable."

"That may appear to be true at the present time," her husband replied. "But I hardly think that people will see any connection between occupation and respectability 15 or 20 years from now. Public attitude is changing. When I was young a man a clerk was much superior to an artisan or mechanic but no such distinction is made today. Apprentice training will go a long way to dignify trade work. The foundry business must be respectable because I find that even college graduates are taking it up."

"I am sure that few college men are going into the foundry business," Mrs. Parker continued. "I don't know of a single young man of our acquaintance, college man or not, who plans to become a foundryman."

"That's just the beauty of it, Ma," Leslie burst out enthusiastically. "When none of the young chaps go into the business I can work my way up without a lot of competition. I'd sooner be the only young high school graduate in a foundry than be in some other business and have a great many young fellows around, all looking for a few good jobs."

Opportunities Are Offered

"Perhaps that's true," the mother reluctantly admitted.

"I am sure it's true," the father returned. "And in any case, no good can come of trying to make Les do anything he doesn't want to do or trying to prevent him from doing what he does want to do. And we know that Mr. Jordan at the school has made a careful study of the situation in the city during the last few years and he has figures—we have all seen them—which prove that the foundry industry offers a greater opportunity for young men than any other in the city."

"And I want to be an apprentice," Les resumed eagerly, "I want to get systematic training and not just a job."

"Do you know of any foundry in the city which has an apprentice training course?" Mrs. Parker asked, convinced that there was none.

"No, I don't," Les answered. "The only way to find one is to go out and look for it."

And so it was that on the following morning Leslie Parker sallied forth on his bicycle, determined to find employment as foundry apprentice. In his pocket was a list of foundries compiled from the telephone directory.

The evening before the foundrymen of the city had agreed that apprentice training might be a good thing but that nothing could be done about it because the young men, particularly the best of them, could not be induced to go into the business. Here was a young man of high caliber actually looking for apprentice training in the foundry trade. Let us see what happened to him as he went to the various foundries looking for work.

It so happened that the first foundry at which he called was in charge of the man who had made them all laugh the night before by his suggestion of a rush of school leaders into the foundry industry after graduation.

This foundry property was enclosed by a tall, stout wire fence except where a driveway entered the yard through a wide gate. On one side of the driveway stood a low building of sooty brick and over a door in this building hung a weatherworn sign, "Employment." An elderly man sat in his short sleeves on one side of the gate, his chair tilted back against the wall of the building. He wore a cap like a street car motorman's and a nickel plated star on the lapel of his vest.

Too Much Interference

Young Parker rested his bicycle against the gatepost and started to walk toward the employment office. The man hailed him. "Where are you going?" he asked.

"In there," the boy replied, pointing to the door.

"What do you want?" the man continued.

"A job."

"What kind of a job?"

"I would like to find work as an apprentice."

"As what?"

"As apprentice."

The man was clearly perplexed but unwilling to give away his ignorance.

"But this is a foundry; we don't need those fellows in our business," he explained.

Les realized that nothing could be gained by further talk with the watchman.

"Let me go into the office," he suggested.

"No, you don't," the man commanded, rising.

"Why not?"

"'Cause we want men here; we've got no place for kids."

As Leslie still hesitated, the other grasped the collar of his coat and gradually but unmistakably led him back to his bicycle.

At the second foundry the employment office entrance was on the street and Leslie entered immediately. Inside he found long, well worn benches along the wall at one side, a railing down the center, and beyond the railing, three old fashioned desks sadly lacking varnish. Two men sat at one of the desks talking in low voices. Both looked deliberately at him as he entered but continued their conversation. At intervals they laughed uproariously. Les waited 10 minutes,

20 minutes. Then he sat down on one of the benches and studied the safety posters on the wall which showed pictures of blind men who had not worn goggles, one armed when who had neglected cuts and scratches and men in the hospital who had tried to make electrical repairs themselves. No one else came in.

After 30 minutes had passed, one of the men took a large sheet of paper from his pocket and spread it out on the desk and both studied and discussed it. When the boy had been there for nearly an hour the paper was folded up and put away and then one of the men prepared to go but both stood in a rear door talking for a quarter hour more before he finally went.

Perseverance Is Rewarded

Then the survivor took a long look at Leslie and without a word proceeded to sharpen a pencil. Then he made entries in a leather covered book which lay on his desk. Ten minutes later he closed the book and said, "Well, kid?" without looking up, just as if Les had come in that moment.

"Is there a chance to be an apprentice in this plant?"

The man smiled, more to himself than at the young man and picked up his telephone.

"Mr. Benton," he said and a moment later.

"Mr. Benton, this is Wood. I heard you say a couple of days ago that you wanted to put apprentices into the shop. There is a lad out here who is looking for that sort of thing."

He listened for a moment and then replied, "Oh, he looks pretty good. He's big and strong and I guess he would understand what you told him."

Another pause followed after which the man said, "All right," and hung up.

He then turned to Leslie and directed, "Go up to the main office, the big red building over there, and tell the information girl that you want to see Mr. Benton."

It was 9.15 when the girl told him Mr. Benton was busy and motioned him to be seated. It was 20 minutes after 11 when he was ushered into the office of Mr. Benton, who was clearly an important official in the organization. The room was well lighted, a soft, dark rug lay on the floor and the large desk and table were of a splendor which Leslie had never seen except in the movies. Mr. Benton was well dressed, gray-haired and kindly. The boy amused him.

"Well," he said smiling, "What can I do for you?"

"I was sent here," the young man replied, only slightly awed by the impressive surroundings.

"You were," the man replied, "And for what purpose?"

"I would like to be an apprentice."

Mr. Benton wrinkled his brows for some moments and finally seemed to recollect something out of the dim past. Then he turned thoughtfully to Leslie again.

"Mr. Wood telephoned about you, didn't he? I think you had better go and see our superintendent, Mr. Burke. If you are hired you will work under his directions anyway."

He telephoned to the superintendent that Leslie would come to his office, summoned an errand boy to show him the way and patted him on the shoulder as he went out.

The superintendent's office was smaller than Mr. Benton's, it was dusty and there was not even a suggestion of elegance. It was located in the foundry proper and there was a constant din and roar outside.

The superintendent came in about 12:15. He was clearly not pleased to see young Parker.

"I'm not at all sure that apprentice training will work here," he said with some impatience. "Our president, Mr. Benton, wants us to go ahead with it but we have never had time to work it out or even to talk about it. We're not ready to begin by a long shot.

"I suppose, though, that we might as well face the music now as any other time. I'll tell you what. This is Tuesday. Perhaps I can get my men together within the week and we can talk the matter over and make some plans. Perhaps if you came in next Monday I might have some information for you."

Continues His Quest

It is perhaps needless to say that Parker did not come in the following Monday; he had seen no evidence of the kind of organized training he desired.

After getting lunch at home he continued his quest. In the course of the afternoon he called at seven foundries. In some of them he was given prompt attention, in other he had to wait endlessly. At two of the shops no one seemed to know just which official could give him the information he needed. Everywhere he was immediately or finally told that they were not interested in the training of apprentices. One employment manager was impressed by his manner and appearance and offered him a regular job but that was not what he wanted.

The first call on the following morning made him feel that he had finally come to the right place. The watchman passed him quickly and he was received in the employment office with courtesy and dispatch. The place was neat and orderly and there was an air of alertness about all who were there which he had not seen in any employment office so far. In no time at all he was closeted in a private office with a carefully dressed, well groomed young man who immediately made him feel comfortable and at ease.

"Yes, we train apprentices," he answered in reply to Leslie's question. "We have 20 or 25 on the payroll now and we should like to put on a few more. If you are interested we can engage you if you can furnish suitable references."

"Does your course give all around experience?"

"Yes, the boys work in all departments of the plant and learn the entire business."

"Do you give a contract right away or is there a time for probation?"

The young man displayed signs of slight embarrassment.

"To tell the truth," he said, "we have never drawn up a contract or indenture. We make a verbal agreement and have never felt the need of a formal document. A mutual understanding ought to be enough. You agree to complete the course and we agree to give you full training opportunities."

Work at Last

Les had learned to appreciate the need of a written indenture. However, he continued, "Can you show me a schedule of operations to be done by apprentices, giving the number of hours to be put in on molding bench, coremaking and all the rest of it?"

"We don't work out such a schedule. After all, too much depends upon conditions in the plant. It is all up to the superintendent and the foremen. They will have to hire the apprentices when their training is completed and it is safe to assume that they will lay out a proper course of work."

"Do you mean that the kind of work the apprentices do and how much of it they do depends only upon the bosses in the shop?"

"Exactly."

In spite of his liking for the place, Les was convinced that this was no apprenticeship at all as he understood it, and as soon as he could gracefully depart he was out on the street again.

Two long days were spent in futile search and on the third day he came upon a gray iron foundry producing a miscellaneous line of castings and employing between 700 and 800 men and 35 or 40 apprentices. There was an educational director, indentures to be issued after a 6-month probation, schedules of work and pay, school attendance one half day per week for apprentices. There was everything that Les had accepted mentally as essential to an ideal apprentice course.

Within 2 days he was engaged as foundry apprentice and was given work as molder helper. The work schedule required 400 hours of helping and he was glad of the opportunity to get this more or less disagreeable assignment out of the way first.

The work soon became interesting. He grew familiar with the men, the plant and the product. He and his

molder made pump frames, motor brackets and bases for small turbines and he quickly learned about preparation and ramming sand, venting of molds, setting of cores, the purpose of chills, building gates and other important features of the work. Before long he and his molder were fast friends.

When 300 hours had passed Les thought he would like to be transfered to another molding floor so that his helping time might include as great a variety of work as possible. However, no attempt was made to move him and as this was not specified in the schedule, he said nothing about it.

Four hundred hours were completed and then 450 and still he remained where he was. After 500 hours he spoke to his foreman about it but the foreman merely smiled and told him that he was doing very well where he was. It was clear to Les that the foreman accepted no responsibility in the matter. After 600 hours of helping time Les went to see the educational director and demanded to be changed. He found that no accurate record of his work was kept except in the payroll department and on a time basis only and without reference to the kind of work done. The director thought that he could keep the account of the apprentices' work "pretty well in his head." Moreover, it was evident that he was much more interested in foremanship training and other projects than in apprenticeship.

No contract had been signed as yet and that evening Leslie quit.

By this time most boys would have given up their plan for apprentice training. But not Les. He was discouraged for the moment but started out all over again a day or so later. And then something happened which put an end to all his problems.

This is the first of two articles by Mr. Freund. The second installment, following further the efforts of Les Parker to secure training as a foundry apprentice, will appear in an early issue.—THE EDITORS.

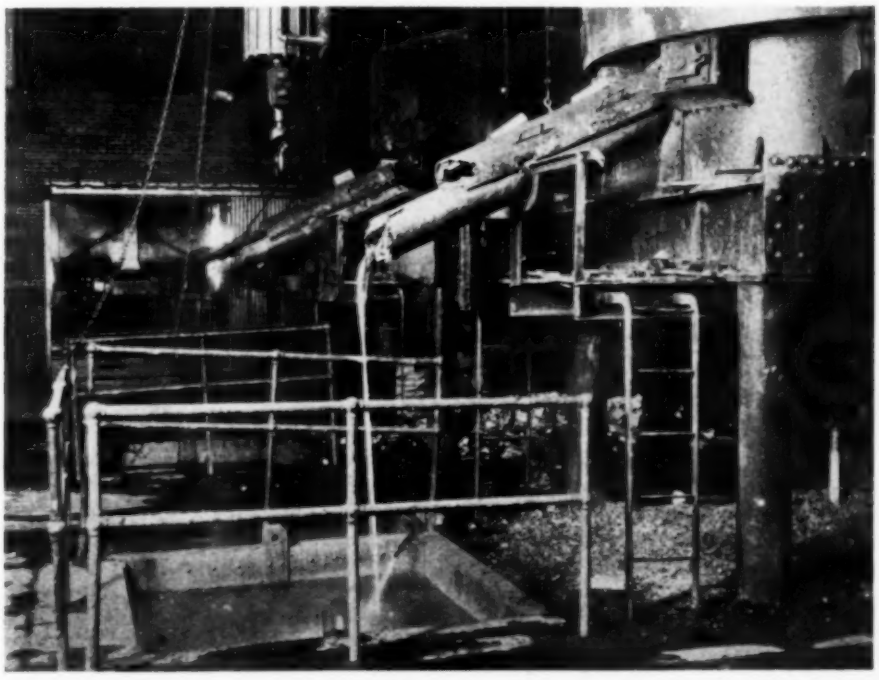
Cupola Slag Is Granulated

By M. J. Gregory

ON PAGE 128 of the April 15 issue of THE FOUNDRY a question was asked regarding slag being granulated. This particular subject has been of interest to the author for some time and an installation for granulating cupola slag is in operation at the foundry of the Caterpillar Tractor Co. at Peoria, Ill.

The thought occurred to me that this might be of interest, as well as information in the future to your readers. The accompanying photograph will give some idea as to how this opereation is carried out.

We have three cupolas in the battery. In the rear of these cupolas we have concrete pits which measure some 7 feet square and 7 feet deep and in which we place buckets 6 feet square and 6 feet deep. These buckets have holes on the sides about 6 inches from the bottom where the water runs out and rises around the tank and flows to the sewer about 6 inches below the floor level. You can see readily that with this arrangement that there is water in the tank and entirely around it as well as underneath it. A stream of water through a ¼-inch pipe, under ordinary main pressure, is running into the tank continually. As the slag hits the water it breaks and gradually settles at the bottom where it breaks up into pieces which will pass through ¼-inch mesh.



Steel Boxes Filled with Water in Pits Behind the Cupolas Receive the Molten Slag as It Flows from the Spouts

When the buckets are practically full of slag the breakage does not become quite so fine. An air hoist above the buckets is used to lift them out of the pit when full and replace them with empty buckets. The buckets are changed about four times daily.

In dropping the bottom of the cupola in the evening, no precaution is taken to cover the buckets. What iron runs out of the slag hole, as it occasionally does, is separated easily from the slag as it more or less forms its own body.

When the bucket is full it is placed on a car and drawn by a Caterpillar tractor to a point underneath the yard crane where it is dumped into a pile or into a gondola.

This fine slag can be used in place of cinders for venting purposes in large cores as well as in concrete.

At the present time our surplus material is hauled away by the railway company for road ballast.

Officers Are Elected

The following men were elected officers of the Roessler & Hasslacher Chemical Co. Inc., New York, at a recent meeting of the board of directors: W. F. Harrington, chairman of the board; Hector R. Carveth, president; Mortimer J. Brown, vice president; Colby Dill, vice president and secretary; Milton Kutz, vice president; E. A. Rykenboer, vice president; Albert Frankel, treasurer; M. D. Fisher, assistant secretary; August Heuser, assistant treasurer; E. A. Howard, assistant secretary; and J. Carlisle Swaim, assistant secretary.

Joe C. Tucker, Morganfield, Ky., has been appointed agent in that territory for portable loaders made by the Link-Belt Co., Philadelphia.

Shop Courses Study Design, Melting and Molding

UNDER the chairmanship of R. F. Harrington, Hunt-Spiller Mfg. Corp., Boston, the first session of the gray iron shop operation course was devoted to a discussion of gates and risers, particularly as applied to gray iron castings. In an attempt by the A. F. A. to standardize the nomenclature pertaining to gating, a sketch was submitted by H. W. Dietert, U. S. Radiator Corp., Detroit, showing several gates with the various parts marked. Reference to these marks by the speaker and discussion from the floor seemed to indicate that carelessness in application rather than lack of knowledge was responsible for the present loose manner in which the various terms are applied in every day practice in the foundry.

Sprue Size Discussed

Under ordinary conditions it was claimed that the size of the sprue should be 1.4 times the size of the gate. This is based on the idea that the opening for the metal should be choked at some point between the pouring cup and the casting. To provide for a clean break off, the thickness of metal in the gate should not exceed 0.8 of the thickness of metal in the casting.

Mr. Dietert again explained the formula which he has evolved for calculating the sizes of the sprues, runners and gates for various types of castings. These formulas have been published in the THE FOUNDRY and in the *Transactions* of the American Foundrymen's association.

With a series of slides, E. M. Handley, Chain Belt Co., Milwaukee, showed a practical application of the foregoing formulas. Making a plea for greater co-operation he claimed that if every foundryman, who succeeded in solving a gating problem during the year, were to submit his findings to the A. F. A., and the technical press, an immense impetus would be given the entire subject.

Max Kuniansky, Lynchburg Foundry Co., Radford, Va., illustrated and described systems of gating he had adopted successfully for pouring large and intricate castings.

Methods of making various types of high test gray iron featured the shop operation course on Tuesday afternoon, which was presided over by Dr. Fritz Meyer, Rockford, Ill. Cupola iron as made by his firm was described in a paper by Ralph S. MacPherran, Allis-Chalmers Mfg. Co., Milwaukee, and read by Dr. E. E. Marbaker, Chicago. Regarding the use of alloys, Mr. MacPherran stated that nickel is added for machinability only and that the alloy is not added to large castings where little machining is necessary. He stated that the liquid shrinkage of the metal is low and that the strength averages around 55,000 pounds per square inch tensile. In the discussion it was pointed out that perhaps the low shrinkage is due to the fact that a quick setting iron is being made. It was stated that speed and temperature of melting has much to do with the shrinkage. By pouring slowly with pop gates and the temperature of the metal high, shrinkage can be controlled. No risers are used.

Report Sessions

DUE to the increased number of technical sessions at the recent convention of the American Foundrymen's association, and the wide diversity of subjects covered, it was found impossible to present all the session reports in the May 15 issue of THE FOUNDRY. *Therefore the reports of the gray iron shop course, the steel shop course and the sand session are presented in this issue.*

Metal Is Superheated

G. L. Simpson, Pittsburgh Electric Furnace Corp., Pittsburgh, spoke briefly on the melting of high test gray iron in the electric furnace. He believes that the entire success of high test iron manufacture is dependent largely on the melting temperature. The high temperatures, which are considered essential, may be obtained easily in the electric furnace. One member of the group stated that when gray iron in the electric furnace is heated from 2850 to 2950 degrees Fahr., a white gas comes off, and that when 2950 degrees is reached, the iron becomes clear. It has been found that this superheated iron is superior to the iron before superheating, in that the machinability is improved and the strength is better. However, no difference is found in the chemical composition. The gas noted is similar to the gas which leaves the spout of the cupola when melting around 2800 degrees. A large automobile company in Detroit now is melting iron in the cupola and superheating it to around 3000 degrees in the electric furnace. It was stated that this makes it possible to obtain a gray iron casting with the same properties formerly obtained with the addition of 1 per cent nickel. The chairman was of the opinion that the molding sand will not withstand temperatures of 3000 degrees.

Air Furnace Method Described

Manufacture of high test gray iron in the air furnace, hand fired with coal for fuel, was described by Duncan Forbes, Northwestern Malleable Iron Co., Rockford, Ill. The charge consists of 60 per cent bessemer pig iron and 40 per cent remelt. The large amount of remelt available results from the large risers necessary in pouring the work. The author pointed out that while features with air furnace melting are unsatisfactory, that a metal of extreme uniformity results. The melting ratio is 2 to 1. Strength of the metal is maintained at 50,000 pounds per square inch tensile, the brinell is between 190 and 210, and the machinability is good.

The chairman described briefly the rotary type powdered coal-fired furnace, which was originated in Europe, and now is being used at the plant of the Birmingham-Goslin Co., Birmingham. Mr. John Shaw, Southsea, England, stated that he had seen a number of these furnaces in operation in Europe, and that he was well impressed with the results being obtained.

Oliver Smalley, Gray Iron institute, Cleveland, spoke on the subject of high test gray iron. Mr. Smalley stated that in his opinion, the most important thing for the foundryman to consider is uniformity. It is necessary that the foundryman be consistent in whatever type

of iron is being made. In melting in the cupola, it is necessary, to obtain high test iron, to melt the metal intensely hot, obtain the correct physical constituents and to control the form and quantity of graphite. All details must be watched carefully.

In making meehanite, Mr. Smalley stated that calcium silicide is added to the iron in the ladle. This iron contains an amount of carbon monoxide, which is changed into colloidal graphite by the action of the calcium silicide. The chemical composition of the iron is not changed and the action is not one of going into solution. Calcium iron silicate, a dry powder, rises to the top and floats on the metal in lumps.

Soda Ash Used

George S. Evans, Mathieson Alkali Works, New York, spoke on the use of soda ash in the melting of high test iron. He stated that its effect on high test iron was not as high as in lower grades, since the high temperatures at which the metal is melted tends to clear the mixture. He stated that the use of soda ash removes inclusions and prevents segregation. The product has been used in foundries since 1867.

Tuyeres, coke, fluxes, mechanical charging as against hand charging, scrap, briquetting and refractories were the subjects considered at the gray iron shop operating course on Wednesday, under the chairmanship of P. T. Bancroft, John Deere Harvester Works, Moline, Ill. Various phases of cupola operation were outlined in the discussions.

Leading the consideration of tuyeres, John Grennan, University of Michigan, Ann Arbor, Mich., pointed out that size has less significance in relation to cupola operation than is often attributed. The ideal tuyere, he said, offers little resistance to the passage of air, and tuyeres may be of the slant type for slag control, but this type offers little benefit to cupola operation. He asserted the tuyere should not be regarded as an air nozzle.

J. T. MacKenzie, American Cast Iron Pipe Co., Birmingham, Ala., in discussing coke, suggested smaller coke as more advantageous in obtaining proper temperatures, particularly in smaller cupolas. Even in larger cupolas, he said, coke of 2 inches and up has been found more advantageous than coke 3 inches and up.

Fluxes were considered under the direction of Charles Scullin, St. Louis, who said the physical constituency of limestone is of more significance than chemical content. He pointed to additional refractory costs that arise when the limestone in the cupola gets too close to the lining. He explained some of his experiences with various fluxes.

Satisfactory results obtained by mechanical charging, including the loading of the charge on the materials floor in charging buckets by means of a magnet, were given by Max Kuniansky. He asserted that consistent uniformity has been obtained over a long period by mechanical charging. It was brought out that mechanical charging of the coke does not result in greater consumption than by hand charging.

Advantages of briquetting cast borings and turnings are dependent economically upon local scrap market conditions, it was stated by Hyman Bornstein, Deere & Co., Moline.

The closing gray iron shop course was devoted to melting practices and cupola operations, and a study of the reports of the gray iron subcommittees on recommended practices. The session was under the chairmanship of John Grennan, University of Michigan, Ann Arbor, Mich.

Previous consideration of the recommended practices had been made at other sessions with discussions by R. S. McPherran, Allis-Chalmers Mfg. Co., Milwaukee, W. H. Rother, Buffalo Foundry & Machine Co., Buffalo, and Hyman Bornstein, Deere & Co., Moline, Ill. Suggestions on the tentative reports concerned 54-inch cupola operation, calculation of cupola mixtures, and analysis for classes of castings. The subcommittees have taken steps for early consideration of revisions in line with suggestions and criticisms, at the 1932 convention of the American Foundrymen's association. The reports are scheduled for adoption at that time as recommended practice.

Has Many Advantages

F. K. Vial, Griffin Wheel Co., Chicago, led the shop course discussion on the hot blast cupola, emphasizing the economical and metallurgical advantages of the hot blast cupola, and its susceptibility to adaptations. He pointed out that mechanics of the hot blast cupola will be improved in the future. J. T. MacKenzie, American Cast Iron Pipe Co., Birmingham, Ala., described the hot blast cupola with suspended vertical pipes inside the cupola, citing the advantage of lack of tendency to chill or form a bridge at the tuyere. R. S. McPherran discussed the melting of steel scrap in the cupola, citing the tendency in the industry to increase the amount of steel melted. Edward E. Marbaker, Industrial Research & Engineering Co., Pittsburgh, discussed the coke bed, balance of oxygen, depth and ratio of the coke charge, and distribution of pig iron in scrap metal charges. He pointed out that with the generally used 2000-pound coke charge, the thickness of the coke bed rarely is determined in actual practice with exactness.

It's a Core

ONE of the interesting features of the recent exhibition of foundry equipment and supplies at Chicago was the bust of Lincoln on display at the booth of the Werner G. Smith Co., Cleveland. This bust, made entirely of core sand, was produced by Wally Jensen, core boss, Wisconsin Cylinder Foundry Co., Racine, Wis. Mr. Jensen used only a file in shaping this interesting piece of work.

Discuss Sand Data

DEFINITE standards of permeability, bond strength and moisture must be established and maintained if success is expected in the use of synthetic sand according to L. B. Knight, National Engineering Co., Chicago. Answering a question from the floor at the conclusion of reading his paper at the session Tuesday afternoon, the author stated that equipment is necessary for removing the fines. This may take the form of a screening device or an air blast.

Dr. H. Ries, Cornell university, Ithaca, N. Y. presented a report on the study of sand grains. The report was illustrated by a number of

slides indicating the difference in the size and shape of the sand grains from various deposits. According to the report, rounded grains in a mold or core, insure greater permeability than is obtained from sand in which the grains are angular.

In a second report, the author elaborated on the first in showing how the relation between the sand grains is reflected in the strength of the sand when rammed in a mold or core. In the preparation of the first report the author acknowledged the assistance rendered by Mrs. G. D. Conant, and in the second by H. V. Lee, both of Cornell university.

Papers also were presented by W. M. Saunders Jr., Providence, R. I. under the title "Effect of Heat on the Permeability of Facing and Core Sands," and by C. E. Jackson, U. S. bureau of standards, Washington, under the title "Distribution Index for Sand." The discussion following Mr. Saunders' paper centered around the effect of sea coal on the hardness of the casting. The meeting under the chairmanship of R. F. Harrington, Hunt Spiller Mfg. Co., Boston, closed with a reception of committee reports of progress during the year.

Consider Steel Casting Design

PROBLEMS of casting design in relation to defective steel castings formed the base of an interesting and informal discussion in the steel shop operation course presided over by Maj. R. A. Bull, Electric Steel Founders' Research group Tuesday afternoon. In conformity with a suggestion by the chairman the discussion took the form of a series of personal experiences by several members touching on problems presented at various times and the methods adopted in solving these problems.

Theories Are Presented

The perennial problem of why a batch of defective castings occasionally appears for no apparent reason, and with no change in the procedure incident to the preparation of the metal and the molds, elicited a number of theories. C. N. Ring, Sivyer Steel Casting Co., Chicago, submitted that in some instances defects are due to the condition of the metal, the temperature, amount of oxides present and the working of the furnace. Manner in which the castings are shaken out, sometimes is responsible.

J. Howe Hall, Taylor-Wharton Iron & Steel Co., High Bridge, N. J., stated that this feature is watched closely in his plant, particularly on large or intricate manganese steel castings. Immediately the casting is poured an experienced man marks on the flask the time the casting is to be shaken out.

J. M. Sampson, General Electric Co., Schenectady, N. Y., described the trouble at one time experienced in casting a large steel ring which cracked in the vicinity of the gate. The trouble finally was eliminated by digging holes in the sand on both side of the ring near the gate and filling the holes with water after the casting was poured. This served as an effective chill and equalized the cooling speed of the metal.

The value of brackets is offset unless the brackets are designed to set before the metal in the casting. The practice of allowing indiscriminate cutting of brackets was deplored. In several plants the brackets either are placed on the pattern, or an experienced man is delegated to cut them in the molds. The concensus of opinion was that designers are willing to modify designs if the foundryman explains the necessity.

A general outline of procedure in the steel foundry cleaning room was presented by the chairman, E. F. Wilson, Indiana Harbor Works, American Steel Foundries, in opening the meeting devoted to that phase of shop practice. Various methods and various types of equipment are found in the cleaning department. The particular method, or particular types of equipment have been adopted and installed with two objects in view. The first is to expedite the work and turn out a presentable salable product. The second is to accomplish the desired purpose at the lowest cost.

A great deal of interest was aroused by the statement of a member that he installed a new type of sandblast nozzle last November and only had discarded it about the first of May after approximately 900 hours actual service.

Use Hard Iron Nozzles

In answer to a question, J. M. Sampson stated that he is using hard iron nozzles made in the company's malleable iron foundry in Erie. Each of these nozzles costs 8 cents and serves for a day. At the beginning of the day the inlet of the nozzle is ⅜-inch and the outlet ½-inch. These sizes are increased to approximately ½-inch and ¾-inch and then the nozzles are discarded due to the increased consumption of air.

Charts for computing grinding costs precipitated a lively discussion on speeds and life of grinding wheels. A typical report showed a peripheral speed of 8500 feet at which 30 pounds of steel per hour were removed for 27 hours. In another instance a wheel removing 28 pounds per hour removed a total of 1100 pounds.

Various features in connection with the nitriding process of steel castings occupied the attention at the concluding session Thursday afternoon of the steel section of the shop operation courses, under the chairmanship of J. R. Houston, Harnischfeger Corp., Milwaukee.

This patented process is operated under license by several prominent steel foundries in the United States, and presents four main characteristics: Imparts a brinell hardness of 900 to 1100 to the surface of the casting; renders the metal noncorrosive; resists temperatures up to 900 degrees Fahr., for prolonged periods and up to 1400 degrees for short periods; the process does not distort the casting.

Illustrating the last feature it was stated that on a test, a 3-inch steel shaft 130 inches in length showed a distortion of only 0.006-inch upon the conclusion of the process. To obtain the best results the casting should be machined lightly. The depth of penetration is approximately 0.031-inch with the maximum hardness about 0.001-inch below the surface.

The castings or other objects to be treated are packed in air sealed containers and then raised to a temeprature of 975 degrees Fahr. and held for a period of 80 hours. During this period the castings are subject to the action of ammonia gas. Several methods are available for selective treatment that is where certain parts of the surface are to be untreated.

The remainder of the session was devoted to the discussion of various features connected with heat treatment, annealing, normalizing and quenching carbon and alloy steels in large and small castings. On large castings an annealing temperature higher than the ordinary 1650 degrees Fahr., is required to secure proper penetration. In some instances a triple and in extreme instances a quadruple heat treatment is required for maximum properties.

Publishes Statistics

American Iron & Steel institute, 75 West street, New York, has issued special statistical bulletin No. 3—1931 which gives figures on the production of ingots and castings, finished forms of rolled iron and steel, and miscellaneous iron and steel products in the United States in 1930. According to the report a total of 1,104,215 gross tons of steel castings were produced in 1930 as compared with 1,583,040 gross tons in 1929, a

decrease of 478,825 gross tons. The total tonnage was distributed as follows: Basic open hearth, 369,798 tons; acid open hearth, 413,675 tons; bessemer, 14,871 tons; crucible, 690 tons; and electric, 305,181 tons.

Production of alloy steel castings also fell from 192,920 in 1929 to 126,128 tons in 1930. That tonnage was divided among the various processes as follows: Basic open hearth, 15,364 tons; acid open hearth, 81,584 tons; bessemer, 50,655 tons; crucible, 581 tons; and finally the electric furnace process, 61,240 tons.

According to the report 1,435,936 net tons of cast iron, gas, water, soil and plumbers pipe and fittings were manufactured in 1930 as compared to 1,650,591 net tons in 1929. Of that amount made in 1930, gas, water and culvert pipe contributed 1,138,862 net tons; soil and plumbers pipe, 188,040 net tons; gas, water and culvert fittings, 47,177 net tons; and soil and plumbers fittings, 61,857 net tons.

Reader's Comment

EDITOR'S NOTE—*Material Appearing Under This Head Does Not Necessarily Reflect the Opinion of* THE FOUNDRY *or of Its Editors.*

The Finest Number

TO THE EDITORS:

Upon looking over the April 15 issue of THE FOUNDRY I am prompted to write you and tell you that I think it is one of the finest numbers you have ever gotten out and you deserve a lot of credit. It is certainly a real achievement, not only in its makeup and the material therein but the advertising pages are likewise something to be very proud of. It seems to me that to have secured the advertisements for as much space as this number indicates is something that your entire organization should be proud of.

I think this number will materially help the attendance at the Chicago meeting and I therefore personally and also on behalf of our association thank you for this valuable help.

N. K. B. PATCH
President
American Foundrymen's Association

To Stimulate Sales

TO THE EDITORS:

When I glanced through the April 15 issue the first thought that occurred to me was in all of my reading of THE FOUNDRY magazine, covering a period of many years, I have never seen so many stimulating statements and so much worth while data in reference to the products of the foundry brought together by the users of castings. If I were in the commercial casting business and desired to stimulate sales I certainly could find no better way at the present time than gather together the pertinent facts as presented by various leaders of industry and users of castings to show what men think who have intimate knowledge of the value and uses of castings in industry.

I think it is a very excellent thought and you must receive many commendatory letters, particularly from an industry which in many respects has been very hard hit during the past few years and with such advertising as has detracted many users of castings to other lines of thought. This issue coming as it does in the midst of a business depression and prior to our annual A.F.A. convention I am sure will be very helpful in many directions. You are indeed doing a worth while job and I wish to personally compliment you on such accomplishment.

E. H. BALLARD
General Electric Co.,
West Lynn, Mass.

The Most Important Thing

TO THE EDITORS:

Thanks for your handsome April 15 issue of THE FOUNDRY. It seems that in your attempt to picture the relation of castings to various fields of human activity you have almost succeeded in making castings the most important thing in modern life.

F. E. SCHMITT
Editor
Engineering News-Record
New York

A Real Inspiration

TO THE EDITORS:

I have never acted as a Pro Bono Publico nor have I joined the Vox Pop club of *Liberty*, but I was inclined to get up last night after having read THE FOUNDRY magazine in bed, and write you just that kind of a letter!

I think the April 15 issue was a real inspiration and particularly so at this time. Anyone who may have felt that the foundry industry or any phase of it was approaching decadence would be without the slightest vision if he could not get a real inspiration for the future from the splendid review of the possibilities of the industry that this issue holds.

Personally, I think it's the best thing that's happened to "Foundry" both magazine and industry in a long time.

L. S. PEREGOY
President
Sivyer Steel Casting Co.
Chicago

Steel Group Has Cost Figures

TO THE EDITORS:

In my judgment the study you are making of the relation of cost of raw materials and labor to selling price and the information it is calling forth to price-per-piece vs. schedules and the effect of unused capacity in increasing the overhead, constitute a most constructive piece of work.

I believe that most of the purchasing agents are sincere in their desire to learn more about what steel and other kinds of castings cost to produce, not out of curiosity, not to use as a weapon to beat down price quotations, but as a matter of information which will give them some idea as to what to expect in the way of price fluctuations due to changes in price in the raw materials and labor markets.

Otherwise, how are they to know whether their source of supply is not setting unduly high and unjustified prices? How otherwise can they know if they are getting a fair price—not necessarily the lowest that some one foundry might quote.

From the fullness of our knowledge of cost factors and their relation to sales price, I am glad to contribute some data which may be helpful in clarifying this question insofar as the steel foundries are concerned. As you know, the Steel Founders' Society has for many years engaged in accumulating cost information contributed by members. Based on this data, we have developed certain relationships which I think will be enlightening.

An examination of the records on one group of our foundries shows that in February, March, and April, 1929, three of the industry's best months, the average selling price per ton of castings was a certain amount which we have taken as a base or index and called 100.00. Contrasting this with the three months' period—November and December, 1930, and January, 1931, three of the lowest months from the standpoint of production, we find the average selling price among this same group of foundries (identical plants), taken on the same basis, was 95.10 per ton, a reduction of about 5 per cent.

To determine what effect the cost of steel scrap, pig iron and other metals had on this reduction, we checked back and found that in this same three months' period in 1929, the average cost index (on the basis of selling price equals 100) of metals per ton of castings was 14.40 as against 12.37 in the 1930-31 period, or a drop of 2.03 per ton of castings.

To ascertain the effect of the cost of labor on selling price, we find the total labor cost per ton of castings in the 1929 period was 31.85, whereas in the 1930-31 period labor represented 32.40 per ton based on aver-

age selling price. This indicates the foundries in this group actually paid 0.65 more per ton of castings in the 1930-31 period than in the high production period of 1929.

This is explainable by reason of the fact that the steel foundries have retained most of their employes and have made no drastic wage cuts. With smaller volume of work passing through the foundry, obviously the labor cost per ton would not be as low as with heavier production.

The index of other costs consisting of such items as fuel, depreciation, supplies, repairs, etc., ran 16.35 per ton of castings in the 1929 period compared with 22.63 per ton in the 1930-31 period, an increase of 6.28 per ton for the low production period. This is partially explained by the fact that the cost of furnace operation per ton increases as the volume of metal melted decreases since more fuel is consumed and more repairs, depreciation, etc., must be absorbed per ton of metal poured.

General overhead and profit index for the 1929 period for these same foundries was 37.40 per ton of castings as against only 27.70 per ton in the 1930-31 period, a drop of 9.70.

Now, in 1929 a survey revealed the average earnings per dollar invested in the business was less than 5 per cent so it is obvious the percentage of profit in 1929 was certainly not excessive. It must therefore be clear that the drop in spread for general overhead and profit really represents a drastic cut, and in a number of cases a complete wiping-out of profits which were only nominal even in the period of high production and large sales. A summary of these facts is given in the accompanying table.

This table shows clearly that these foundries, and they may be taken as fairly representative, are accepting a cut from overhead and profit margin of about 10 per cent per ton, and we know that this is meaning an actual net loss of as much as 10 per cent to 12 per cent on the business handled in the low-production period.

Labor, depreciation, taxes, and many other important factors affecting cost did not diminish appreciably during the recent business recession. In most cases, therefore, it will be found that the foundries are paying unabsorbed overhead out of reserves or surplus and not charging some of this expense into the sales price of their product.

The remarkable thing about the whole situation is that the foundry, as well as other industries, have been quoting the low prices they have, for in numerous instances they are practically donating a portion of free overhead expense, with every order.

Excess or idle capacity created by a falling off of business is the problem of the foundry, not the customer, and there is no desire to complain about that phase of the situation. It will right itself in a measure, it is hoped, with the return to normal business conditions.

With competition so relentless as it is in these days and with little to compensate them or justify them for price cuts which have been forced by that competition, sometimes against the evidence of their cost figures, a large number of the steel foundries are content if during the business lull, they are able to pay most of their fixed charges and retain a majority of their operating forces.

While the foundries are not complaining, it is obvious they are not growing rich in these times, even though the prices being quoted may frequently seem high at first glance as compared with selling prices during boom times and that they are just trying to hold their own under adverse circumstances.

GRANVILLE P. ROGERS
Managing Director
Steel Founders' Society of America
New York.

Average Cost and Selling Prices

SECURED FROM A GROUP OF STEEL FOUNDRIES DURING A HIGH AND A LOW PRODUCTION PERIOD

	February, March, April, 1929	November, December, 1930, January, 1931
Average selling price per ton	100.00	95.10
Average cost of metals per ton	14.40	12.37
Average cost of labor per ton	31.85	32.40
Average cost of other mfg. expenses, etc	16.35	22.63
General overhead and profit	37.40	27.70
Total	100.00	95.10

Liquid Iron Is Denser

TO THE EDITORS:

In the April 1 issue of THE FOUNDRY I noticed a question in the section devoted to foundry problems entitled "Iron Floats on Bath." It interested me and I will comment from a practical standpoint and personal observation. Iron in its liquid state is denser than in the solid state. Many a time I have used from 1 to 3 hundredweight of iron in a 2-ton ladle to chill the molten iron; it being too hot for the purpose intended. Hard or solid iron always will float when introduced into a bath of hot iron. The intense heat also has an effect on the cold iron. When the cold iron has absorbed enough heat it will melt and mix with the balance of the hot iron. This is what is called chilled iron.

Devlin Mfg. Co. CHARLES N. GIRON
Burlington, N. J.

Practical Man Is Needed

TO THE EDITORS:

I have read with interest an article by Pat Dwyer in the April 15 issue of THE FOUNDRY entitled "Why Sand Draws Down from the Cope." A number of reasons may be responsible for this as with nearly all foundry troubles. The cause suggested may or may not be responsible. I am inclined to think the trouble may be caused by the use of a sand that is too fine and close and not well vented, but the real cause cannot be determined without a knowledge of all the circumstances and conditions. A good, practical man on the job should be able to locate the cause. I have made heavy castings without any such trouble. The gates may not be large enough to fill the mold rapidly. Leaving the risers uncovered and allowing the gases to blow through, may cause the cope to pull down. So many things cause the same defect that only a well trained and experienced man can figure out the source of the trouble. A man of this kind is a decided asset to any foundry.

GEORGE E. CARLIN
14 *Rimbach Street*
Hammond, Ind.

Uses Manganese Scrap

TO THE EDITORS:

After the World war started, ferromanganese became scarce, and high in price, and I began to use high manganese steel scrap which contained about 12 per cent manganese with excellent results. I have melted from 5 to 100 per cent steel scrap in our cupolas, and have experienced no trouble in getting it out hot and into the molds. I have cast marine, locomotive and stationary engine cylinders from metal with manganese steel scrap as one of its components, and it is close in grain and the castings withstood water pressure as high as 400 pounds per square inch. I also have cast pressure hydraulic rams and cylinders which take a high polish. Silicon in steam cylinders ranged from 1.0 to 1.40 per cent, and in the hydraulic castings as low as 0.30 per cent according to size and thickness. To mix manganese steel scrap in my metal, I added 20 pounds of scrap to every 100 pounds of steel scrap.

J. B. S.

What Others Are Thinking

Abstracts Selected from European Foundry Literature

Describes Cupola Practice

The Operation of Cupolas, (La Conduite des Cubilots), by Ivan Lamoureux. *Bulletin of the Association Technique de Fonderie de Belgique*, Liege, January, 1931.

Efficiency of a cupola depends more upon its method of operation than upon its construction. The preparation and placing of the brick lining should be done at the rate of about 3 to 5 feet in height per day. It also is suggested that a coke fire should be lit at the base of the cupola each evening so that by the time the lining is finished it practically is dried. When the lining is rammed, steel rods are placed between the lining and the shell of the cupola. When the rods are removed, a passage remains which enables the moisture to escape. The diameter of the cupola always should be maintained at its original size.

The smaller the pieces charged in the furnace, the easier they are melted. Pig iron or scrap should not exceed half the diameter of the cupola in length if hanging of the charge is to be avoided. When charging the furnace for the first time, coke is first charged, followed by pig iron and scrap. If any steel is used, it is charged before the iron. The last charge should be coke, so that the charge lays between two layers of incandescent coke. This prevents a too great oxidation of the metal. The cupola always should be practically full. Care should be taken to see that scrap is cleaned well before being charged into the cupola. The first slag should be tapped one hour after the cupola has been started. That operation should be continued at regular intervals of ½ or 1 hour, according to the size of the cupola.

Toward the end of the melt, the foundry foreman sometimes finds that he will not have enough metal for his requirements, and one or two charges are added. That is considered bad procedure, as these charges require an additional amount of coke, and air is blown into a partly empty cupola, which tends to destroy the lining.

Improves Casting Design

Patternmaking and Its Relationship to Design and Foundry Practice, by Mathew Russell, *Foundry Trade Journal*, London, April 9, 1931.

Production of casting involves design, patternmaking, molding, casting, cleaning and finishing. Close co-operation should exist between the patternmaking department and the foundry in every shop but unfortunately it does not in many cases. Lack of foundry knowledge among designers is a contributing factor to the inroads which other fabricating processes have made in the casting field. However, it is possible through improvement design and in patternmaking to retain and in many cases reclaim those jobs which are threatened. Redesign and proper patternmaking procedure will reduce the cost of castings in many instances. The adoption of labor saving devices also is another method by which costs may be reduced.

Among the points that will aid in the reduction of casting costs is the conservation of technical data, so that once a job has been run it is not necessary to go through an experimental period to secure a good casting. Another is chaplet design which sometimes is faulty. Places for chaplets should be marked on the pattern and thus reduce the hazard of improper placement. In some instances it is better to make two castings in place of a single casting as the procedure often is cheaper and gives more satisfactory results. There are many patternmaking saving devices which could be adopted with little or no increase in molding costs.

Describes Feeding of Castings

A Few Remarks on Feeder Heads in Bronze Foundry Practice (Quelques Remarques sur les Masselottes en Fonderie de Bronze) by Marcel Debrock. *Bulletin of the Association Technique de Fonderie*, Paris, January, 1931.

Following a short summary on the theory of cooling in a casting and an explanation of the temperature gradient, the causes of the formation of shrink-holes in the upper part of a casting are explained. If there is a sufficient volume of hot metal on the upper part of the casting to fill the shrinkage hole, the casting will be sound, and it is this additional mass of metal which constitutes the feeder head.

The temperature gradient has an influence on the feeding of the casting, and the best results are obtained when cooling is rapid. Therefore, it is advisable not to pour the metal too hot. However, there are cases, where it is necessary to use comparatively hot metal, and in such cases it is necessary to employ a higher feeder.

The shape of feeder heads is of considerable importance, and this shape is determined by the following principles: The feeder must have a sufficient reserve of liquid metal to fill the shrink-hole; the metal must be supplied at a sufficient pressure to enable it to reach the farthest points of the casting and the feeder must be such as to exert its action until the casting is completely solidified. Consequently, the feeder head must take longer to solidify than the casting itself, and should be shaped to utilize a minimum quantity of metal. The optimum shape is an inverted pear, or a shape that approaches this section as far as is practicable.

In a casting of uniform thickness, which is at all flat, the best position for a feeder is about the center of the casting, but it is better still if a flat casting can be poured vertically, with a feeder head at the top. In a casting representing a range of thicknesses, it generally is admitted that the heavier portions of the casting can be looked upon as feeding the thinner portions;; consequently, it is usual to place a feeder head upon the heavier parts of the casting.

Another method, which is not widely known and which presents certain difficulties of application, has been suggested by M. de Fleury and consists in placing the feeder head not exactly on the heavier part of the casting, but next to it.

Makes Cast Iron Rolls

The Manufacture of Cast Iron Rolls (Die Herstellung von Gusseisen-Walzen), by Ernst Peipers, *Stahl und Eisen*, Duesseldorf, Germany, March 19, 1931.

According to the author two main types of rolls are used in the iron industry and they are differentiated by the type of molding into loam or what would be termed sand-cast in this country, and chilled rolls. The two groups are further subdivided into the class of work performed in use. Profile rolls such as used in rolling angles, I-channels, rails, etc. are made in loam molds. The flask is made in two halves and the mold is swept up with a sweep-board of the proper profile. The molds are dried thoroughly, blacked and dried again. The molds are gated at the bottom in such a manner as to give the entering iron a rotary motion which carries any slag and kishy particles to the center and into the riser at the top. After pouring, the rolls are fed through the riser. A 5-ton roll will require about 3 hours feeding, and a 20-ton roll about 7 hours. Total carbon varies from 2.2 to 2.8 per cent; silicon from 0.5 to 1.3 per cent; manganese from 0.5 to 1.2 per cent; phosphorus from 0.2 to 0.3 per cent, and sulphur from 0.06 to 0.12 per cent.

Chill molds for that type rolls vary in thickness from 4 to 10 inches in Germany as compared to up to 15 inches in America and England. The depth of chill varies with the silicon, and a simple rule is that 0.01 per cent silicon varies the chill 1 millimeter (0.04 inches). The composition of large sheet chilled rolls shows 2.6 to 3.0 per cent carbon; 0.5 to 0.7 per cent silicon; 0.5 to 0.8 per cent manganese; 0.2 to 0.4 per cent phosphorus, and 0.07 to 0.12 per cent sulphur. Additions of nickel, chromium and molybdenum are made to increase the hardness and wear resistance. An instance is cited of a roll containing 4 per cent nickel and 2 per cent chromium which had a brinell hardness of 600 on the surface, and the gray interior was so hard that tungsten carbide cutting tools hardly could touch it.

DAN M. AVEY
Editor

The Shakeout

FRANK G. STEINEBACH
Managing Editor

PAT DWYER
Engineering Editor

EDWIN BREMER
Metallurgical Editor

CHARLES VICKERS
Nonferrous Editor

NORMAN F. HINDLE
Assistant Editor

¶ Whose Fight Is It?

ANY man who believes that he is doing a trade association a distinct favor by being a member thereof is flattering himself. Those organizations made up of a membership of this type, fortunately, are unknown in the foundry industry. Here the proper attitude of mind governs, namely an appreciation for the co-operation of others in the same line of endeavor. Nevertheless, this properly appreciative spirit needs supplementing and the collective backbone represented by the membership of trade associations needs a shot of stiffening serum.

RIGHT at present a trade association executive is particularly fortunate if he has back of him a strong, energetic staff of officers and board and a membership capable of contributing that support and drive which the times require. The prime question before all trade associations is dealing with those within or outside their membership who, knowingly or unknowingly, seek to tear down the price structure. The pressure for low prices justifies only in a small measure the precipitate retreat often instituted upon the false claim of "keeping the men employed."

PRICE cutting is based upon one of two factors, desperation or ignorance. Both of these factors, can be combated actively and energetically by every member of each of the three trade associations of the foundry industry, the Gray Iron institute, the Steel Founders' Society of America and the Malleable Iron Research institute. This fight has progressed beyond the stage of planning by the directing officers of the association and must be carried into every sector by each member of the groups in question. Reinforce the courage of those faced by desperation and educate the ignorant. Under no circumstances meet competitors' price cuts by further reductions. No one ever won a price war.

¶ The Wait of Weights

ANY movement for the betterment of industry, or in fact of any division of modern civilization, usually meets with considerable opposition, often becoming a long, drawn-out affair. Some get on the band wagon at once, others must be sold, and, sad as it may seem, a few must be classed as irreconcilables. Seven years ago, Thomas E. Durban of Erie, Pa., started a movement to have the approximate, or if known, the correct weights of castings placed on the blueprint supplied by the customer. Obviously, economies for both the foundry and the customer would accrue from such a practice. Nevertheless, this movement has not met unanimous approval.

THEREFORE, it is interesting to note that in reporting for the subcommittee to formulate data which should be supplied when estimates are requested, Robert E. Belt, Malleable Iron Research institute, Cleveland, chairman, reported progress in educating customers. In the list of information which should be supplied with customer's inquiries, the report includes the following: "If drawing is furnished, the actual weight of the casting should be given. If the actual weight is not known, the estimated weight should be given." Since this report is to be presented to the National Association of Purchasing Agents for consideration, it appears that the movement soon may have the support of interested parties.

¶ It Must Have IT

HAS the rapid mechanization of industry been one of the major causes of the business depression and should that villain the engineer or scientist, be given a 25 year vacation, as has been advocated by some? No, says C. F. Kettering, vice president of General Motors Corp., Detroit. He blames the decline in business to stagnation and over standardization; to a lack of research and development.

RESEARCH, according to Mr. Kettering, should keep everyone reasonably dissatisfied with what he has; should find out what you can do when you can't do the things you have been doing. Instead of developing new products during the past ten years, too much attention has been paid to production. When something new is introduced, the public is ready to buy. Witness the recent sale in New York, where moderate-priced television sets were offered and police had to be called to keep the purchasers in line. The banks are bursting with money which the people will not spend because there is nothing to entice them.

THESE words of an executive and a scientist are very refreshing after hearing the calamity howlers predict the end of industrial development. Also, it rather stresses the importance of finding new markets and products, an idea which has been impressed so often in THE FOUNDRY.

Comings and Goings of Foundrymen

Men of the Industry, Whose Activities Are Making Foundry History

MAJ. PIERRE NICOLAU, author of the exchange paper of the French Foundry Technical association, presented at the recent A.F.A. convention, holds distinctions for war services and literary and technical achievements. Among the degrees and honors which he holds are master of science, engineer and Chevalier de la Legion d'Honneur. In 1929 Maj. Nicolau was appointed supervisor of the electrical,

Maj. Pierre Nicolau

mechanical and physical testing laboratories attached to the technical section of artillery. He now is a director of the latter department which constitutes the principal center of investigation for the French artillery. He has contributed numerous articles on testing methods and investigations in ballistics which have been published in many of the leading French technical journals. Maj. Nicolau has invented a number of testing appliances among which are a highly sensitive induction balance for thermomagnetic analysis, an appliance for shock traction tests for bicycle chains and a ballistic chronograph. He also has conceived and improved methods for the control and testing of heat treating cartridge cases and has investigated new methods of testing for cast iron. Maj. Nicolau is the representative of the French war office on the committee for cast iron testing methods of the Association Technique de Fonderie. He recently was elected general secretary of that committee. He also represents the French war office on the standardizing committee for iron and steel products set up by the federation of mechanical construction industries and also serves as the French representative on the international standardizing committee.

Oscar Schwegel has been appointed superintendent, Dayton Casting Co., Dayton, O., to succeed the late Ernest Ackerman.

John J. Hockey, formerly president, Superior Casting Co., Dayton, O., has become associated with the Dayton Casting Co., Dayton, O., in a sales capacity.

C. H. Harmon, formerly connected with the Black Hawk Mfg. Co., and Litchfield Mfg. Co., both of Waterloo, Iowa, and the Conedy-Otto Co., Chicago Heights, Ill., has purchased a half interest in the Superior Brass Foundry, Waterloo.

E. H. Mebs, formerly metallurgist, Watertown arsenal, Watertown, Mass., has been appointed chief metallurgist, Ohio Steel Foundry Co., Lima, O., in connection with all company products, particularly in the manufacture of steel and alloy rolls.

Frank J. Herkal, former owner of the Flour City Brass & Aluminum Co., Minneapolis, and later salesman for the General Metals Refining Co., St. Louis, has been appointed general superintendent, Progressive Metal Products Inc., Minneapolis.

Frederick B. Cooley, president, New York Car Wheel Co., and **Robert E. Dillon,** vice president and general manager, Lake Erie Engineering Corp., both of Buffalo, have been elected directors of the Buffalo Chamber of commerce for 3 year terms.

Edward M. Wrede, for the past year foundry superintendent, Foster Stove Co., Ironton, O., has resigned his position with that firm. Previous to his connection with the Foster company, Mr. Wrede was foundry superintendent, Monitor Furnace Co., Cincinnati, for 12 years.

Howard Coonley, president, Walworth Co., Boston, has been appointed chairman of the committee of the board of directors of the American Standards association on certification and labeling. **George K. Burgess,** U. S. bureau of standards, Washington, also is a member of the committee.

W. C. Schmeling has been elected president and general manager, Wisconsin Art Bronze & Iron Co., Milwaukee. He has been manager of the Milwaukee plant of General Bronze Corp., for two years. **Fred Van Kooy** is vice president of the new company, and **A. R. Stark** secretary-treasurer.

James E. Jones, formerly superintendent, roll department, South Chicago works, Illinois Steel Co., has become associated with the Continental Roll & Steel Foundry Co., Chicago. Mr. Jones retired April 30 in accordance with the new pension plan of the United States Steel Corp. He has had 62 years experience in rolling mill work starting with his associa-

James E. Jones

tion with the Burden Iron Works Co., Troy, N. Y. in 1869. He left the company 6 years later to go with the Carnegie-Kloman Co., Pittsburgh. He stayed with that company for 5 years when he became connected with the Pencoyd Iron Works, Philadelphia, for 6 years. In 1886, Mr. Jones joined the Colorado Fuel & Iron Co., Pueblo, Colo., where he remained until 1893 when he returned to the East to become associated with the Passaic Rolling Mill Co., Paterson, N. J. From 1900 until 1902, he was connected with the Dominion Iron & Steel Co., Sydney, Nova Scotia. Following that connection, he was associated with the Seaman-Sleeth Co., Phoenix Roll works, Pittsburgh. For a few months in 1904, he held a position with Ferreria de Tula, Jalisco, Mexico. Mr. Jones became superintendent, roll department, South Chicago works, Illinois Steel Co. on Feb. 22, 1905 and held that position until his recent retirement.

Ernest L. Watson has resigned as president and general manager of the American Furnace & Foundry Co.,

Monroe, Mich., positions he has held since the company was organized in 1920. He also resigned similar positions with American Boiler & Foundry Co., an associate interest organized in 1924. He remains as director of both companies. His successor has not been named.

J. Walter Becker, president and general manager, Turner Brass Works, Sycamore, Ill., has resigned because of poor health, and has been succeeded by **John Slezak** who has been works manager since 1930. Mr. Slezak is a graduate of the University of Wisconsin in mechanical engineering. Previous to his work at the Turner Brass Works, he was connected with the Western Electric Co., Chicago.

Clark P. Pond, formerly vice president, David Lupton's Sons Co., Philadelphia, has been appointed vice president, Truscon Steel Co., Youngstown, O.

Neil E. Salsich

Made Sales Manager

Neil E. Salsich, formerly manager of railroad and mining sales, Bethlehem Steel Co., Bethlehem, Pa., has been appointed vice president and general sales manager, Jeffrey Mfg. Co., Columbus, O. Mr. Salsich was born in Hartland, Wis., and attended Beloit college, Beloit, Wis. After leaving school in 1903 he became affiliated with the Pennsylvania Steel Co., Steelton, Pa., remaining with that company and with the Bethlehem Steel Co. by which the former was absorbed, for 28 years. During that time, he served in various capacities in both the operating and sales departments at the Steelton plant; in the Boston, Chicago and Philadelphia sales offices; and at the home office of the Bethlehem company in Bethlehem, Pa. Mr. Salsich is interested particularly in special track work and served on that committee of the American Electric Railway association.

DIRECTORY OF FOUNDRY ASSOCIATIONS

American Foundrymen's Association

President, N. K. B. Patch, Lumen Bearing Co., Buffalo; executive secretary-treasurer, C. E. Hoyt, 222 West Adams street, Chicago; technical secretary, R. E. Kennedy, 222 West Adams street, Chicago. Annual meeting, Stevens hotel, Chicago, May 4-7, 1931.

Associated Brass Founders of New England

President, George W. Thornburg, Crescent Park Brass Foundry, Waltham, Mass.; secretary, Herbert H. Klein, Pennsylvania Foundry Supply Co., 310 Congress street, Boston. Meetings the fourth Wednesday of each month at the Engineers' club, Boston.

The Buffalo Foundrymen

President, J. McArthur, Washington Iron Works; secretary, W. J. Wark, E. J. Woodison Co., 140 Chandler street. Meetings each month at club rooms, 140 Chandler street.

Central Illinois Foundrymen's Club

President, H. M. Hire, Hire Foundry Co., Peoria, Ill.; secretary, Franklin Whitehead, The Meadows Mfg. Co., Bloomington, Ill.

Chicago Foundrymen's Club

President, L. E. Gilmore, Crane Co., Chicago; secretary, Albert N. Wallin, S. Obermayer Co., 2563 West Eighteenth street. Meetings first Thursday in each month at the City club, 315 Plymouth court.

Connecticut Foundrymen's Association

President, Carl S. Neumann, Union Mfg. Co., New Britain, Conn.; secretary, Charles S. Parker, Charles Parker Co., Meriden, Conn. Meetings are on second Friday of each month in various parts of the state.

Connecticut Nonferrous Foundrymen's Association

President, C. H. Blanchard, Reading Steel Casting Co., Pratt & Cady division, Hartford, Conn.; secretary, C. D. Elliott, Wilcox, Crittenden Co. Inc., Middletown, Conn. Meetings held the second Monday of each month at place to be named. Recent meetings have been held at Hotel Garde, New Haven, Conn.

Detroit Foundrymen's Association

President, James L. Mahon, American Car & Foundry Co.; secretary, Neil I. McArthur. Meetings third Thursday in each month, except December, June, July and August at Ft. Shelby Hotel.

East Bay Foundrymen's Association

Secretary, O. R. Moller, Electric Steel Foundry Co. Inc., 1328 Second street, Berkeley, Calif.

Electric Steel Founders' Research Group

Director, R. A. Bull, Central Office, 541 Diversey Parkway, Chicago.

Gray Iron Institute

President, B. H. Johnson, Florence Pipe Foundry & Machine Co., Florence, N. J.; manager, Arthur J. Tuscany, Terminal Tower building, Cleveland.

Malleable Iron Research Institute

President, R. R. Fauntleroy, Moline Malleable Iron Co., St. Charles, Ill.; secretary, Robert E. Belt, Union Trust building, Cleveland.

Metropolitan Brass Founders' Association

President, William Ember, Jefferson Brass Foundry, 62 Delevan street, Brooklyn, N. Y.; secretary, William E. Paulson, Thomas Paulson & Son Inc., 97 Second avenue, Brooklyn, N. Y. Meeting second Wednesday in each month at the Building Trades club, 2 Park avenue, New York.

Newark Foundrymen's Association

President, W. H. Mantz Atlas Foundry Co., Irvington, N. J.; secretary, G. W. Hannay, Barnett Foundry & Machine Co., Irvington, N. J. Meeting called by president. Scheduled meeting date, May 27.

New England Foundrymen's Association

President, Luther J. Anthony, Glenwood Range Co., Taunton, Mass.; secretary, Fred F. Stockwell, 205 Broadway, Cambridgeport, Mass. Meetings held the second Wednesday of each month excepting July and August at the Engineers club, 2 Commonwealth avenue, Boston. Outings usually are held in the months mentioned.

Ohio Foundries Association Inc.

President, A. H. Kramer, Advance Foundry Co., Dayton, O.; secretary, Robert Hoierman, 418 Penton building, Cleveland.

Pacific Coast Founders Association

President, Charles J. P. Hoehn, Enterprise Foundry Co., 2902 Nineteenth street, San Francisco; manager, S. M. Truitt, 55 New Montgomery street, San Francisco.

Philadelphia Foundrymen's Association

President, C. F. Hopkins, Ajax Metal Co., Philadelphia; secretary, Earl Sparks, 1623 Sansom street, Philadelphia. Meetings the second Wednesday of each month at the Manufacturers' club.

Pittsburgh Foundrymen's Association

President, H. F. Siefert, Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa.; secretary-treasurer, William J. Brant, Wm. J. Brant, Bessemer building, Pittsburgh. Meetings on the third Monday of the month, except in July and August at Fort Pitt hotel.

Quad-City Foundrymen's Association

President, E. A. Gullberg, Union Malleable Iron Works, East Moline, Ill.; secretary-treasurer, Stanley Brah. Meetings the third Monday of each month, the meeting place being rotated between Moline, Rock Island and Davenport.

St. Louis District Foundrymen's Club

President, Horace R. Culling, Carondelet Foundry Co., St. Louis; secretary-treasurer, Leo J. Filstead, John C. Kupferle Foundry Co., St. Louis. Meetings the fourth Thursday of the month at 6:30 p. m., at the American Annex hotel, Sixth and Market streets, St. Louis.

Southern Metal Trades Association

President, John S. Schofield, J. S. Schofield's Sons Co., Macon, Ga.; secretary, W. E. Dunn Jr., Flatiron building, Atlanta, Ga.

Steel Castings Development Bureau

Research Director, George Batty, 500 Stock Exchange building, Philadelphia.

Steel Founders' Society of America

President, W. H. Worrilow, Lebanon Steel Foundry, Lebanon, Pa.; managing director, G. P. Rogers, Graybar building, New York.

Tri-City Technical Council

Chairman, C. F. Scherer, Davenport Machine & Foundry Co., Davenport, Iowa; secretary, E. C. Xander, assistant secretary, Tri-City Manufacturers association, Moline, Ill. Combined meetings held only one or two times a year on call.

Tri-State Foundrymen's Association

President, William Hoppenjanz, The Star Foundry Co., 221 Main avenue, Covington, Ky.; secretary, C. C. Erhart, Chris Erhart Foundry Co., Cincinnati. Meetings the second Thursday of each month at the Cincinnati club, Eighth and Race streets.

Twin City Foundrymen's Association

President, William J. Snyker, St. Paul Foundry Co., St. Paul; secretary-treasurer, C. E. Langdon, 3849 Lyndale avenue, south, Minneapolis. Meeting third Wednesday of each month at Athletic club.

Washington Foundrymen's Club

President, J. P. Jensen, Prescott Co., 1 West Lander street, Seattle; secretary, Edward C. Gustin, 3716 Grayson street, Seattle. Meetings second and fourth Tuesdays of each month at the Elks Temple, Fourth avenue and Spring street.

Western Foundrymen's Association

President, H. T. Hornsby, Joplin, Mo.; secretary, E. L. Graham, Acme Foundry & Machine Co., Coffeyville, Kans.

Wisconsin Gray Iron Foundry Group

Secretary, W. F. Bornfleth, Cutler-Hammer Inc., Foundry Division, Milwaukee. Meetings on second Wednesday of each month at Hotel Schroeder, Milwaukee.

OBITUARY

John O'Brien, one of the partners of the North Star Foundry Co., Minneapolis, died recently.

J. George Lehman, 56, president and general manager of the Bethlehem Foundry & Machine Co., Bethlehem, Pa., died suddenly May 14, at his home in Bethlehem.

Louis J. Mueller Jr., 64, president of L. J. Mueller Furnace Co., Milwaukee, and of its subsidiary, the Manufacturers Foundry Co., died May 4.

George H. Leidiger, 46, treasurer Northwestern Malleable Iron Co., Milwaukee, died May 5.

Charles Isaacson, 57, one of the founders of the Milwaukee Flush Valve Co., Milwaukee, died recently He was born in Bangor, Me. Before he retired several months ago because of failing health, Mr. Isaacson had been treasurer of the company.

James N. Heald, president, Heald Machine Co., Worcester, Mass., died May 6. He was born in Barre, Mass., Sept. 21, 1864. Following his graduation from Worcester Polytechnic institute, Worcester, Mass., he entered his father's business which has been founded by his grandfather, Stephen Heald, in 1826. The company was established to do jobbing machine work and later produced agricultural and wire drawing machinery. An iron foundry was added to the plant in 1850. At the time Mr. Heald became affiliated with the business, his father and grandfather were operating it. When the latter died in 1888, the firm became L. S. Heald & Son with Mr. Heald as manager. Shortly after his assumption of the managership, the company began the manufacture of grinding machinery. Mr. Heald purchased his father's interest in 1903, organized the Heald Machine Co., and transferred the business from Barre to Worcester. Prior to his death he had turned over the management of the company to two sons, Rogers N. and Richard A. Heald.

To Hold First Congress

The first international congress of the New International Association for Testing Materials will be held in Zurich, Switzerland from Sept. 6 to 12 in the buildings of the Swiss Federal Polytechnicum. Discussion during the meeting will be divided into four general groups namely, metals, nonmetallic inorganic materials, organic materials, and questions of general importance. The session on metals will be under the direction of Prof. W. Rosenhain, National Physical laboratory. Teddington, England, and cast iron; strength of metals at high temperatures; fatigue; notched-bar impact test, and the progress of metallography will be discussed. Prof. W. von Moellendorff, Deutscher Verband fuer die Materialpruefungen der Technik, Berlin, Germany, will direct the discussion on questions of general importance which will include fundamental and test relations between elasticity and plasticity, toughness and brittleness; determination of grain size in loose materials, and calibration and accuracy of testing machines. Further particulars on the congress may be obtained from W. H. Fulweiler, American Society for Testing Materials, 1315 Sprue street, Philadelphia, or from the general secretary, Leonhardstrasse 27, Zurich, Switzerland.

Portable Grinder Is Electrically Driven

A new portable, electrically-driven, hand grinder and buffer recently has been placed on the market by the Standard Electrical Tool Co., Cincinnati. The machine, shown in the accompanying illustration, is equipped with a ½-horsepower high-frequency motor operating on 220

Grinder Weighs 20½ Pounds

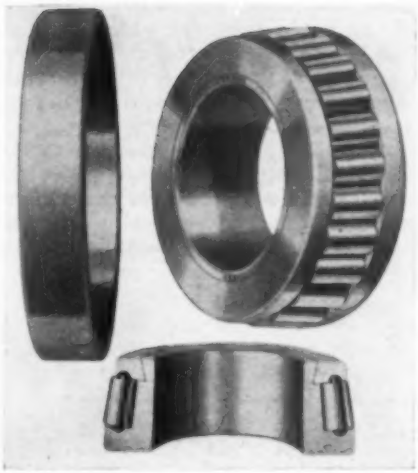
volt, 60 cycle, 3-phase alternating current. It uses a 6 x 1-inch high speed bakelite bonded wheel with a ⅝-inch bore. The spindle travels at a speed of 5400 revolutions per minute, is 26 inches long and 4½ inches in diameter. It is equipped with ball bearings that run in oil in dust proof chambers. The switch is of the trigger type and the cable contains four wires, one of which is utilized as a ground. Weight of the apparatus is 20½ pounds.

Introduces New Type Roller Bearing

Tyson Roller Bearing Corp., Massillon, O., has introduced a new type roller bearing which has no cage or retaining ring. Positive alignment is maintained by a double ribbed backplate at the large end of the rolls. The shoulder of each roll bears on the inside of rib of the backplate and has an additional bearing on the outside rib. Pintles at both ends of the rolls extend into annular grooves in the backplate and the closing rings thus holding the rolls in place when the cup is removed.

It is claimed that omission of the cage leaves room for 20 to 50 per cent more rolls. The result is a large load carrying capacity for a given size. Increased durability and less maintenance cost also are claimed for this new type bearing.

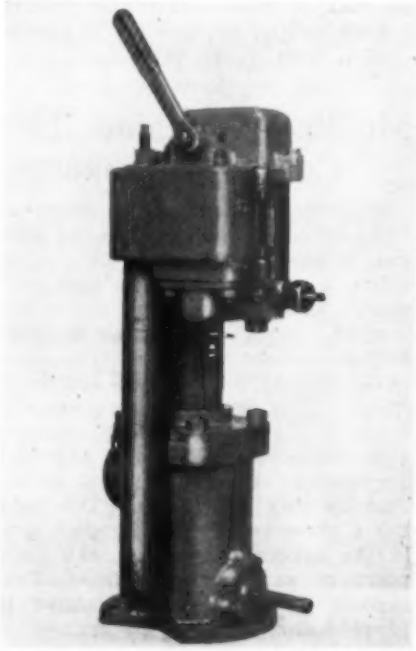
The new type bearings are made in all S. A. E. sizes and are interchangeable for all types of antifriction bearing installation. Present methods of adjustment may be applied to the new bearing. The accompanying illustration shows several views of the new bearing.



The Bearing Is Made in All S. A. E. Sizes

Ramming Is Regulated by Timing Valve

A fluid timing valve designed especially for regulating the number of jars given a mold to give the same sand density throughout each mold, recently has been introduced by the Herman Pneumatic Machine Co., Zelienople, Pa. The valve consists of four main parts, the operating assembly which includes the cover, operating handle, cams, etc., that open the air inlet and hold it open until the handle lock is released automatically or manually; the air supply assembly which opens or closes the inlet air supply and regu-



The Valve Is Attached to the Air Supply Line

lates the outlet air supply; the metering valve assembly which controls the length of time the air supply remains open; and the oil reservoir, containing the fluid, strainer and oil level gage.

The mechanism is attached to the air line and is independent of the jarring machine. When the handle of the valve is pushed down, the lock latch engages, holding the air inlet valve open. The air flows past the outlet regulating valve and enters the oil reservoir forcing the oil past the needle regulating valve into the metering chamber where it moves the metering piston upward until it releases the lock latch on the handle and closes the air inlet. Oil in the metering valve returns to the reservoir through a quick opening one way valve. Oil flowing past the needle valve can be regulated to allow the air inlet to remain open from 2 seconds to 2 minutes. The air inlet may be closely instantly by lifting upward on the handle. A special fluid is used in the valve.

Standard Equipment on This Machine Includes Vibrator, Pressure Gauge, Blow Valve, Riddle Rack and Shelf

Molding Machine Has Cantilever Yoke

Tabor Mfg. Co., 6225 Tacony street, Philadelphia, has placed on the market a squeezer type molding machine equipped with a cantilever yoke. The yoke operates easily and is rigid. The pins on which the yoke swings are not used for adjustment to accommodate different depths of flasks. The pins are permanent and work in accurately reamed, replaceable bushings. The yoke and link are made of steel and the link has an exceptionally wide base. The yoke has a three point support when it is in the squeezing position, the third point of support being fixed. That method of mounting is claimed to provide great rigidity.

The ramming block is adjustable readily and requires only a short time to make adjustments for various flask depths. The machine is claimed to be sand-proof and all guide rods are inside the main cylinder. The squeezing piston is protected by a cast iron sand guard. Standard equipment includes vibrator, pressure gauge, blow valve, riddle rack and shelf. The machine is available in either the portable or stationary types. The portable machine has a wheel spread of 22 inches and 26 inches are required behind the machine to allow complete backward travel of the yoke. The accompanying illustration shows one of the new machines.

Nonferrous Foundrymen Discuss Melting

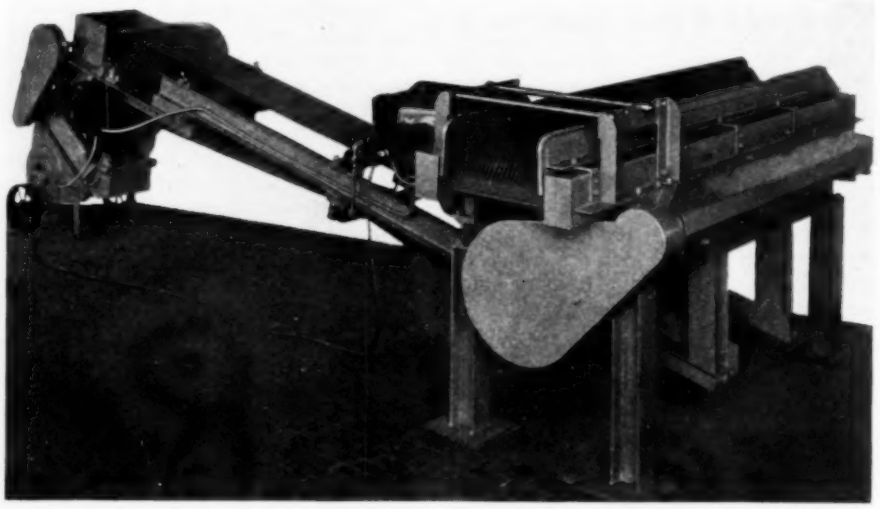
The regular monthly meeting of the Connecticut Nonferrous Foundrymen's association was held, May 18 at the Hotel Garde, New Haven, Conn. The attendance was the largest of any meeting since the organization of the group. B. Schmehl, the Barrett Co., New York, was the speaker and discussed "The Fixed Carbon Method of Melting Brass and Bronze." C. Blanchard, Pratt & Cady division, Reading Steel Casting Co., Hartford, Conn., presided and led the discussion.

Louis G. Tarantino, Niagara Falls Smelting & Refining Corp., Buffalo, chairman of the entertainment committee, announced that the next meeting will be held at the New Haven Yacht club, New Haven, Conn., June 15. C. A. Crawford, International Nickel Co., New York, will be the speaker at the next meeting and will have for his subject, "Foundry Practice on Nickel-bearing Nonferrous Alloys." As the association holds no meetings during the summer months, the June meeting will be the last held until fall.

Unit Combines Shakeout and Sand Preparation

Royer Foundry & Machine Co., Kingston station, Wilkes-Barre, Pa., recently introduced a new unit for shaking out molds and reconditioning the sand. The unit is composed of the shakeout equipment manufactured by the company and its sand separator and blender connected in the form of a *T* by a tempering belt. When a mold is placed on the shakeout, the sand is jarred from it automatically and falls through the device onto the tempering belt practically free from scrap. Castings, gates, gaggers, etc., are delivered to the end of the unit.

After the sand falls on the belt, which conveys it to the sand separator and blender, the heat is dissipated and the sand is tempered. It then passes through the separating and blending machine from which it is discharged in a mixed and tempered condition ready for the molder. The unit is designed compactly and is installed easily. The accompanying illustration shows one of the units.



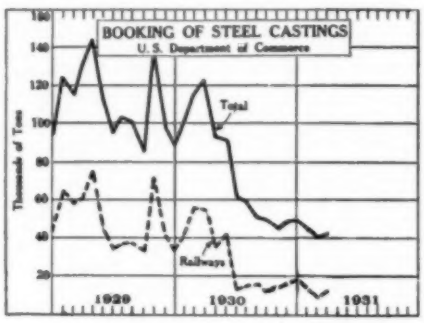
Castings, Gaggers, Gates and Scrap Are Delivered to the End of the Shakeout and the Sand Is Conditioned and Made Ready for the Molder in This Unit

Trade Trends in Tabloid

WHILE industrial activity has shown slight recessions during the past few weeks, the losses have been less that generally were anticipated. Discounting seasonal influences, the general trend of business has been upward for several months, indicating that recovery is progressing slowly. The continued demand for automobiles and the volume of miscellaneous freight moving are encouraging factors.

—T—T—

Increased demand for several types of equipment has improved operations in numerous foundries. Shops



making castings for textile machinery are more active and steel foundries are receiving heavier orders for road making and steel making equipment.

—T—T—

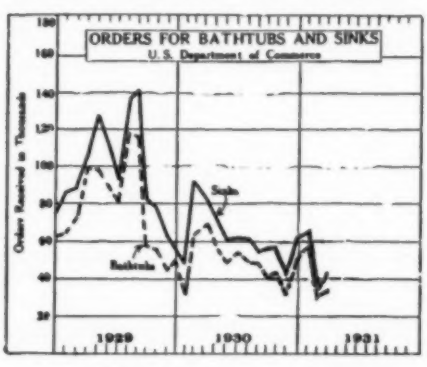
April was the fourth consecutive month in which the daily rate of pig iron production gained, according to *Steel*. Production of merchant iron in April totaled 393,767 tons compared with 358,749 tons in March.

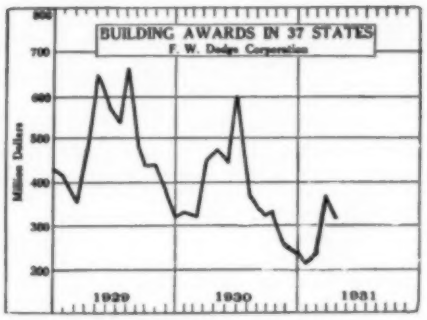
—T—T—

Index of gross orders for foundry equipment, as compiled by the Foundry Equipmnt Manufacturers association, declined in April to 56.1, compared with 174.4 in March. It is interesting to note that of the gross orders reported in March, 60 per cent were for export and 40 per cent for domestic use, while in April, 23 per cent were exported and 77 per cent for domestic consumption.

—T—T—

Moderate gains in several foundries in the Chicago district at mid-





May were countered by further reductions in operating schedules of several shops, leaving average operations at about the same level. An important malleable plant increased production, while several steel foundries reduced the days of operation. Western Michigan foundries specializing in automotive work are maintaining operations at approximately the same level as in April, and have fair prospects for June.

—T—T—

According to the Gray Iron institute, Cleveland, production of gray iron in March increased for the third consecutive month and for the second month production, new business and unfilled orders all gained. Production in March was 60.4 per cent of normal, compared with 55.3 per cent in February.

—T—T—

Automobile production in April, according to preliminary estimates, approximated 348,000 units, compared with 276.341 units in March.

RAW MATERIAL PRICES
May 21, 1931

Iron	
No. 2 foundry, Valley	$17.00
No. 2 Southern, Birmingham	12.00 to 13.00
No. 2 foundry, Chicago	17.50
No. 2 foundry, Buffalo	17.00
Basic, Valley	17.00
Basic, Buffalo	17.00
Malleable, Chicago	17.50
Malleable, Buffalo	17.50
Coke	
Connellsville beehive coke	$3.25 to 4.75
Wise county beehive coke	4.25 to 5.00
Detroit by-product coke	8.00
Scrap	
Heavy melting steel, Valley	$10.25 to 10.75
Heavy melting steel, Pitts.	11.00 to 11.50
Heavy melting steel, Chicago	8.50 to 9.00
Stove plate, Buffalo	8.00 to 8.50
Stove plate, Chicago	7.00 to 7.50
No. 1 cast, New York	7.50 to 8.00
No. 1 cast, Chicago	8.75 to 9.25
No. 1 cast, Philadelphia	13.00
No. 1 cast, Pittsburgh	11.00 to 11.50
No. 1 cast, Birmingham	10.00 to 11.00
Car wheels, iron, Pittsburgh	11.50 to 12.00
Car wheels, iron, Chicago	9.25 to 9.75
Railroad malleable, Chicago	9.50 to 10.00
Agricultural mal., Chicago	9.00 to 9.50
Malleable, Buffalo	11.00 to 11.50
Nonferrous Metals	**Cents per pound**
Casting copper, refinery	8.60
Straits tin	23.10
Aluminum, No. 12, producers	22.00
Aluminum, No. 12, remelt	10.00
Lead, New York	3.75
Antimony, New York	6.45
Nickel, electro	35.00
Zinc, East St. Louis, Ill.	3.35

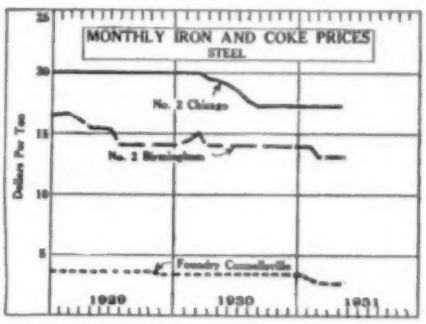
While production declined slightly, only 1½ per cent, the second week in May, it is believed that the May output will be close to the total for April.

—T—T—

Bookings of steel castings in March, according to the department of commerce, totaled 46,638 tons, compared with 40,292 tons in February.

—T—T—

A report of the Steel Founders' Society of America, New York, shows that 8.3 per cent of the membership reporting consider the business outlook good, 70 per cent fair and 21.7



per cent poor. Fifty-three per cent are operating below 50 per cent, 39 per cent between 50 and 69 per cent, 5 per cent between 70 and 89 per cent and the remainder over 90 per cent of capacity.

—T—T—

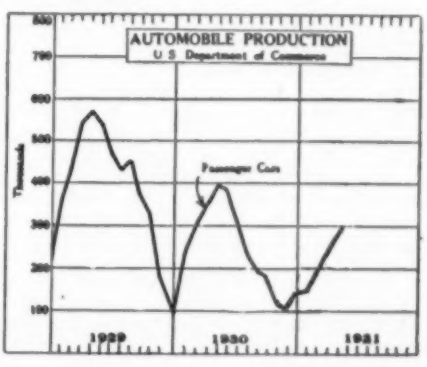
Index of machine tool orders in April stood at 105.1 against 117.6 in March and 83.7 in February, according to the National Machine Tool Builders association, Cincinnati.

—T—T—

Production and orders for malleable castings in March were the highest since last June, according to the department of commerce. Production totaled 35,039 tons while orders were received for 36,467 tons.

—T—T—

Output of gray iron foundries in the Philadelphia district was 4.8 per cent greater in March than in the previous month, according to the industrial research department of the University of Pennsylvania.



What the Foundries Are Doing

Reflecting the Activities of Gray Iron, Malleable, Steel and Brass Shops

Somerville Stove Works Haynes and C. R. R. of N. J., Somerville, N. J., has discontinued its foundry.

John R. Geisinger Co., Grenloch, N. J., recently has been sold to the Oswald Lever Co. Morgan Perry as president.

Foundry of the Red Cross Mfg. Co., Oak and Washington streets, Bluffton, Ind., was damaged slightly by fire recently.

Wilmar Bronze Foundry, 53 King street, Brooklyn, N. Y., recently began operations. H. Wilson and C. Martin are the owners.

Foundry of the Brass & Bronze Specialty Co., 340 Jackson avenue, New York, recently was damaged by fire.

C. A. Lawton Co., Green Bay, Wis., manufactures gray iron, brass and aluminum castings. The company also operates machine and pattern shops.

A. Archambault, 8010 Henri Julien street, Montreal, Que., is manufacturing brass and bronze castings and aluminum die castings.

Apex Aluminum Foundry, 4116 Long Beach avenue, Los Angeles, recently began operations for the production of aluminum castings.

Midway Pattern & Model Works, 700 Raymond street, St. Paul, opened several months ago. H. J. Johnson and H. J. Flaaten are the proprietors.

Ohio State Stove & Mfg. Co., Columbia, O., has changed its name to the Ohio State Stove Corp. M. L. Yuster has been elected president and general manager of the company.

Hardie-Tynes Mfg. Co., Birmingham, Ala., has been awarded contract for approximately 108 tons of rough steel castings for the army engineer, Huntington, W. Va.

Real estate, buildings and equipment of the Van Wert Foundry Co., Van Wert, O., will be offered for auction on June 6. The company's property has been appraised at $30,000.

A new iron foundry has been opened in Port Arthur, Tex. The foundry is equipped for the manufacture of manhole covers, drains and other cast iron products.

Vernon Foundry Co. Inc., 1737 Iowa street, Los Angeles, is manufacturing gray iron, brass and aluminum castings. The company also maintains machine and pattern shops.

Harding Foundry & Furnace Supply Co., Columbus, O., 537 Collins avenue, succeeds the North Side Foundry, formerly located at the same address. (Noted May 15.)

Plantsville Foundry Corp., Plantsville, Conn., has been taken over by a new group of owners which have maintained the former name of the company. (Noted May 15.)

St. Paul Brass Foundry Co., 541 East Sixth street, St. Paul, Minn., recently erected a new foundry, 60 x 90 feet which cost $25,000 with equipment.

Hays Equipment Co., Seventh street, Galva, Ill., has been incorporated with $125,000 capital to conduct a general foundry and machine shop business. Incorporators are F. R. Putnam, E. H. Anthony, and S. A. Griffis.

Lavelle Foundry Co., 1740 West Michigan street, Indianapolis, has resumed operations after being closed for approximately 2 years. T. A. Lavelle is president of the company.

Alliance, O., plant of the American Steel Foundries was closed from May 18 to June 1 while employes took their vacations. Alex Robertson is works manager.

Qualheim Pattern & Machine Works Inc., Racine, Wis., has been incorporated by S. C. Qualheim, P. E. Jorgensen and E. L. Christensen, to deal in machinery and appliances.

Waterloo Foundry Co., Mitchell avenue and Rock Island railroad, Waterloo, Iowa, started operations May 1 for the production of gray iron castings. Sidney Sparks and Andrew Fischels are the proprietors.

Moore Bros Co., 47 Bond street, Elizabeth, N. J., has been working 6 days per week since April 1. The company also enjoyed good business during the past year. Walter H. Cole is president.

H. W. Knight & Sons Inc., Seneca Falls, N. Y., has been incorporated with $45,000 capital to manufacture white metal and brass patterns. Incorporators include Robert W., Horace D. and Robert Knight.

Cleveland Co-Operative Stove Co., 2323 East Sixty-seventh street, Cleveland, is remodeling its plant at 6712 Central avenue. Contract is held by John Gill & Sons, Bulkley building. Cost is estimated at $25,000.

Hansen Engineering & Machinery Co., Lynn, Mass., has been organized by S. M. and Holger Hansen, 10 Oakcrest street, Saugus Center, Mass., with $10,000 capital to operate a foundry and machine shop.

Maryville Foundry, Maryville, Tenn., has been established by George Rutherford. Operations have started on the former site of the McNaughton Mfg. Co. Production will include furnace parts and gray iron castings.

Amos & Stabler Foundry Co., 241 Brookover avenue, Zanesville, O., has been organized by C. L. Amos and P. H. Stabler to operate a jobbing foundry for the production of gray iron castings. Operations began about June 1.

Custom Casting Co., Easton, Pa., has been incorporated by Lippincott Colket, Haverford, Pa., to manufacture and deal in hardware, castings, metals and machinery. Harrison C. Colket, Bryn Mawr, Pa., and Abel P. Wetherill, Wynnewood, Pa., are interested.

Dominion Bridge Co. and Standard Iron Works Ltd., Edmonton, Alta., are undertaking special negotiations with city council preliminary to erection of a foundry to cost $50,000. Plant is to be built at 119th street and 106th avenue.

G. W. West Foundry, successor to Grenloch Foundry & Machine Co., Grenloch, N. J., started operating recently after being closed down for over two years. G. W. West is president, Joseph M. Singer, secretary-treasurer and James Brown is superintendent.

Whitby Malleable Iron & Brass Co., Ltd., Whitby, Ont., is the name of the company formerly operated as the Hatch Mfg. Co. The company produces malleable, brass and aluminum castings and maintains machine and pattern shops.

Didion Foundry & Machine Works, Valley Park, Mo., has moved to Houston, Tex., and has changed its name to Atlas Foundry. The new company which is located at 1800 Oliver street, Houston, Tex., produces gray iron, brass and aluminum castings and maintains a pattern shop.

American Hammered Piston Ring Co., Bush and Hamburg streets, Baltimore, subsidiary of the Bartlett Hayward Co., North Scott street, Baltimore, produces gray iron, brass and aluminum castings and maintains a machine shop, pattern shop and laboratory. The company also operates an experimental laboratory.

Carnegie Foundry & Machine Co., Carnegie, Pa., whose incorporation was noted earlier in the year, will manufacture brass and aluminum castings. The company also operates machine and pattern shops. Later it will construct a laboratory building. The company soon expects to enter the die casting field. (Noted April 15.)

Midway Foundry Co., 700 Raymond avenue, St. Paul, has built an addition to its foundry, 50 x 146 feet, with a pattern shop located on the second story. The company will begin the manufacture of steel castings soon. The crucible and converter methods will be used. W. A. Dougherty is superintendent.

Copper Clad Malleable Range Co., St. Louis, has acquired the foundry building of the Crescent Foundry Co., St. Louis, and will start operations there during the near future. The company has outgrown its former quarters on Franklin avenue. Lloyd Scruggs is president and A. H. Stein, secretary and general manager.

Hosek Mfg. Co., 416-420 West Warren avenue, Denver Colo., is contemplating the erection of a foundry addition, 40 x 75 feet, for the production of brass, bronze and aluminum castings. The company is ready for the submission of drawings for buildings which will utilize overhead electric cranes, core ovens, gas furnaces, etc. H. F. Hosek is president and general manager of the company.

Zane Castings Co., Fair Oaks, Zanesville, O., has begun the construction of a new foundry at Park and Amelia streets, Zanesville. Two buildings will be erected, the foundry, 50 x 100 feet and a storage for patterns, flasks, foundry tools and supplies, 50 x 64 feet. The new construction is expected to be completed by July 15. When the new buildings are completed operations will be discontinued at the old plant. H. V. Dockray is manager of the Zane company. (Noted May 15.)